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CONTENTS

PAGE

BREEDING FOR HIGH YIELD AND DISEASE RESISTANCE IN HEVEA—by E. D. C. Baptiste 38

CUTTING OF BLANKET CREPE AND SOLE CREPE—by K. F. Heinisch 52

REPORT ON THE SULPHUR DUSTING OF SMALLHOLDINGS IN 1959/60—by Ronald T. Wijewantha 56

PLANTING TOPICS 63

QUESTION CORNER 65

MINUTES OF THE 168th MEETING OF THE RUBBER RESEARCH BOARD 67

NOTICES

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(5) Straining box for latex (January, 1940).

(12) Warm Air Drying House for Crepe Rubber (Reprinted 1952).

(33) Mechanical Felling of Rubber Trees (Reprinted March, 1955).

(37A) Manuring—Magnesium Deficiencies in Rubber (July, 1954).

(37B) Potassium Deficiencies (September, 1954).

(38) Planting and After-Care of Budded Stumps and Stumped Budgrafts (Superseding Advisory Circular No. 8) (March, 1953).

(39) Clonal Seed as Planting Material (Superseding Advisory Circulars No. 26 and 27) (July, 1953).

(40) Tapping of Hevea Rubber (Superseding Advisory Circulars No. 17 and 34) (June, 1954).

(41) Pink Disease (June, 1954).

(44) Diplodia Dieback and Collar Rot of Hevea and Blue Spot of Crepe Rubber (June, 1954).

(47) Ustulina Rot of Rubber Trees (November, 1954).

(49) Root Disease in Replanted Areas (Superseding Advisory Circular No. 31) (October, 1951).

(50) Orange Gall of Hevea (December, 1954).

(51) Bird's Eye Leaf Spot of Hevea (December, 1954).

(56) Cover Crops (Superseding Advisory Circular No. 25) (October, 1955).

(57) Notes on Rubber Seedling Nurseries (Superseding Advisory Circular No. 35) (October, 1955).

(58) Notes on Budgrafting Procedure (Superseding Advisory Circular No. 1) (December, 1955).

(60) Sale of Budwood (Superseding Advisory Circular No. 42) (June, 1958).

(61) Prevention of Coagulation in the Field (Superseding Advisory Circular No. 53) (September, 1958).

(62) The White Root Disease of Hevea—Fomes Lignosus (Superseding Advisory Circular No. 46) (October, 1958).

(63) Brown Root Disease of Hevea—Fomes Noxius (Superseding Advisory Circular No. 48) (December, 1958).

(64) Bark Rot and Canker of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 54) (December, 1958).

(65) The Phytophthora Leaf Disease of Hevea—Phytophthora Palmivora (Superseding Advisory Circular No. 45) (December, 1958).

(66) Manuring of Rubber (Superseding Advisory Circulars No. 59 & 59A) (April, 1959).

(67) A Simple Method of Control of Latex Coagulation. (February, 1960)

(68) Minor Pests of Rubber Plantations (June, 1960).

(69) Defects in Smoked Sheet (September, 1960).

* BREEDING FOR HIGH YIELD AND DISEASE RESISTANCE IN HEVEA

By

E. D. C. Baptiste

The selection and breeding of Dothidella-resistant Hevea clones in Brazil is reviewed in some detail. A complete list is presented of these clones imported into Ceylon for breeding work aimed at combining disease resistance with the high yield of Eastern clones, using the backcross method of breeding.

An appraisal is made of the clones on their reaction to Dothidella and to Phytophthora.

Examples are given of apparent breakdown of disease resistance and the importance is stressed of the need for diversification of highly resistant material for use as genotypes.

Since tests of Dothidella resistance can be carried out only in the Western hemisphere, where the fungus is present, the situation of a testing station is discussed and Turrialba in Costa Rica is considered to be the best centre for the purpose.

It is suggested that all natural rubber producing countries should take joint action to have the project implemented by an international body such as the Food and Agriculture Organization of the United Nations.

A plea is made for international co-operation in the field of Hevea production research with a view to securing the future of the natural rubber industry.

Introduction:

All *Dothidella*-resistant clones introduced into the Eastern hemisphere originate from Brazil.

They are the result of breeding and selection work started in 1937 at Fordlandia, a rubber plantation established in 1928, and continued at Belterra, a second plantation established in 1934. Both plantations were developed by the Ford Motor Company on the banks of the Tapajoz River. Fordlandia is about 125 miles up-river from Santarem which is situated at the confluence of the Tapajoz with the Amazon. Belterra is only 30 miles from Santarem and is across the Tapajoz from Boim, the source of the original Wickham seed collection. The early (1937-41) breeding and selection for *Dothidella* resistance was done by the Ford Motor Company plantation personnel. During the years 1942 to 1945 the programme was expanded and carried out co-operatively by the Ford Motor Company, the Instituto Agronomico do Norte and the United States Department of Agriculture. After 1946, when the Ford plantations were sold to the Brazilian Government, the breeding work was continued by the co-operative efforts of the Brazilian and the United States Governments. C. H. T. Townsend Jr. carried out the breeding and selection project in Brazil from its inception in 1937 up to 1958. Co-operating with Townsend on the breeding work were: G. O'Neal Addison of the IAN with

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L. A. Beery Jr. and C. N. Hittle of the U.S.D.A. while K. D. Butler, M. H. Langford and A. M. Gorenz, all of the U.S.D.A., guided and assisted with the resistance tests and with the final selections from the breeding progeny (RANDS AND POLHAMUS, 1955).

The *Hevea* material originally planted at Fordlandia in 1928 was grown from seed obtained from the Tapajoz area of Brazil and later seed was brought to Fordlandia from the Acre Territory, from the Solimoes and Machado rivers and from the Belém area.

Although *Dothidella* was noted on the Fordlandia plantation during its early years of development, the damage occurring was not considered serious until 1933. The factor of site was believed to be the principal reason for the prevalence of *Dothidella*. Consequently the Ford Motor Company in 1934 transferred its major plantation project to the Belterra location and by the end of 1942 had planted a total of 16,230 acres, but this time with budded rubber of the best Eastern clones that had been introduced at Fordlandia early in 1934.

The 7,500 acres of Fordlandia, although ravaged with the South American Leaf Blight, were not abandoned. By 1935 individual seedlings as well as whole seedling populations were showing varying degrees of resistance to the disease. Those derived from Tapajoz seed were all susceptible to the South American Leaf Blight while some that originated from the Belém area or from the upper Amazon regions showed resistance.

Belterra, like Fordlandia, prospered in its early years but as the crowns of the Eastern clonal plantings closed in during 1941 and 1942 South American Leaf Blight gradually spread and by 1943 it had reached epidemic proportions. The extinction of this plantation was only averted by crown budding the entire 16,000 acres with clones made from the trees that had proved resistant to the disease at Fordlandia.

These early resistant selections were known as Ford clones and were designated by the letter F, as for example clone F 1619, a *Hevea brasiliensis* selection of Acre origin, or clone F 4542, a *Hevea benthamiana* selection of upper Rio Negro origin. Clones made from Belém seedlings were differentiated from the up-river selections by the prefix FB, Ford Belém. Crosses made during the Ford Motor Company's administration between *Dothidella*-resistant Ford clones and high-yielding Eastern clones were prefixed FX, as for example FX 4037 made from a seedling of the cross F 4542 × PB 86. Crosses made in 1945 and in subsequent years, under the auspices of the Instituto Agronomico do Norte, have the prefix IAN.

Hevea material available for the breeding programme consisted of *Dothidella*-susceptible Eastern clones, which included some of the best yielders then available (*e.g.* PB 86, Tjir1) and of *Dothidella*-resistant clones from *H. brasiliensis* selections made at Fordlandia and Belterra from regional strains of *H. brasiliensis* and from a number of *Hevea* species collected throughout the vast Amazon basin.

The *H. benthamiana* clone F 4542, nearly immune to *Dothidella ulei* and tolerant to *Phytophthora palmivora*, has been used in the majority of crosses with Eastern clones aimed at combining high yield and disease resistance. No interspecific hybrid families with other *H. benthamiana* or other resistant material have given such a high percentage of *Dothidella* near-immune or resistant progeny as that obtained from F 4542.

Many selections from these families have shown exceptional vigour.

Some idea of the extent of breeding work carried out at Belterra from 1942 to 1957 is given by the number of clones made from *Dothidella*-resistant selections of crosses obtained by hand pollination. The number of these clones exceeds 10,000 out of over 120,000 hand-pollination progenies which have been tested for *Dothidella* resistance.

In Guatemala large-scale breeding work is also in progress and, according to LANGFORD (1957), over 169,000 hand pollinations were made in 1957 at the Rubber Experiment Station at Entre Rios on the West Coast. These included 136,000 second backcrosses or outcrosses to the Eastern clones.

Importation into Malaya:

Negotiations for exchange of *Hevea* clones between Malaya and Brazil were opened in 1948. In 1950, following visits to America by the Director and the Head of the Pathological Division, a plan for exchange was agreed upon between the Rubber Research Institute of Malaya and the Instituto Agronomico do Norte, Belém, Para, Brazil (HILTON, 1955).

The U.S. Department of Agriculture offered the facilities of its Plant Introduction Station situated in Miami, Florida, outside the American tropics for growing the clones under quarantine conditions for at least a year before the despatch to the Eastern hemisphere of budwood certified free of South American Leaf Blight.

Another precautionary measure adopted was to send the East bound budwood disinfected with Fermate to the Commonwealth Mycological Institute, Kew, England, for examination and further disinfection before onward despatch to Malaya.

The *Dothidella*-resistant clones, imported into Malaya in 1953/54, are listed in Table 1. They consist of 9 selections made in Fordlandia (6 of which are from *H. brasiliensis* seedlings and 3 from *H. benthamiana* seedlings of various origins), of 2 selections from *H. brasiliensis* seedlings of Belém origin and of 14 selections from crosses of Ford clones and Eastern clones (F_1)—a total of 25 clones (BROOKSON, 1956).

These clones were introduced into Ceylon from Malaya during 1955.

Importation into Ceylon:

(a) *From the Western Hemisphere*

As a result of the writer's visit to the Americas in November-December 1957, the *Dothidella*-resistant clones listed in Table 2, obtained on an exchange basis from the U.S.D.A. Plant Introduction Station, Miami, Florida, were successfully introduced into Ceylon in December 1957 (BAPTISTE, 1958).

These consist of fifteen selections of crosses of *Dothidella*-resistant clones, mainly F 4542, with high-yielding Eastern clones, of thirteen selections of first backcrosses of clone F 4542 to an Eastern clone and of fourteen selections of first outcrosses of clone F 4542 to an Eastern clone—a total of 42 clones.

These clones were personally selected in December 1957 by the writer in Costa Rica, Guatemala and Brazil from examination of field plantings ranging from four to sixteen years of age.

A second introduction of *Dothidella*-resistant clones from the U.S.D.A. Plant Introduction Station, Miami, Florida, took place during 1959. The twenty clones successfully introduced are second outcrosses of the *H. benthamiana* clone F 4542 to Eastern clones and are part of an exchange of 26 clones agreed upon in December 1957 in Brazil between the Directors of the Rubber Research Institute of Ceylon and of the Instituto Agronomico do Norte, Belém, Para (BAPTISTE, 1959).

These clones, listed in Table 3, are selections from progeny of crosses made at Belterra, Brazil in 1954 and 1955 which had been seen in the *Dothidella* test nurseries at Belterra by the writer in December 1957

(b) *From Firestone Plantations Company, Liberia*

The 29 *Dothidella*-resistant clones listed in Table 4, obtained from the Firestone Plantations Company in exchange for a number of DR clones listed in Table 2, were successfully introduced into Ceylon in 1958/59, following the writer's visit to Liberia in February 1958 (BAPTISTE 1959, 1960).

There are thus in Ceylon altogether 116 *Dothidella*-resistant clones comprising:

11 clones of *H. brasiliensis* and *H. benthamiana* selections of various origins.

33 clones of primary crosses (F_1) between Ford selections (mainly F 4542) and Eastern clones.

21 clones of first backcrosses (BC_1) of clone F 4542 to Eastern clones.

31 clones of first outcrosses (OC_1) of clone F 4542 to Eastern clones.

20 clones of second outcrosses (OC_2) of clone F 4542 to Eastern clones.

It will be noted that the *H. benthamiana* clone F 4542 has been used as a parent in two-thirds of the imported clones selected from the F_1 progeny of *Dothidella*-resistant clones with high-yielding Eastern clones and in all clones of the first and second backcrosses to the Eastern clones.

These importations were carried out strictly in accordance with the conditions laid down by the Plant Protection Agreement for the South East Asia and Pacific Region (FOOD AND AGRICULTURE ORGANIZATION, 1956).

Reasons for Importation of Disease-Resistant Clones:

The main problem facing the rubber plantation industry is that of resistance to diseases. Since there is an ever-present danger of the introduction into the Eastern hemisphere of the most serious leaf disease of *Hevea*, South American Leaf Blight caused by *Dothidella ulei*, one important object of breeding work with *Hevea* is to safeguard the long term prospects of the rubber industry by the provision of planting material possessing the characters of high yield and *Dothidella* resistance.

As all Eastern material tested so far has been found to be susceptible to this disease it was essential to obtain resistant material from the Western hemisphere where it was developed.

The selection of *Dothidella*-resistant clones for importation into Malaya was concerned mainly with their degree of resistance to *Dothidella* and the transmission of this character to their progeny and was not influenced by the question of susceptibility to *Phytophthora palmivora*, a fungus which has never caused serious trouble to *Hevea* in Malaya.

In Ceylon where climatic conditions in the main rubber growing districts favour the incidence in epidemic form of *Phytophthora palmivora* and *Oidium heveae* it is also important to breed material with resistance or tolerance to these pathogens.

In the case of the selection of these clones for importation into Ceylon, therefore, as much importance was attached to *Phytophthora* tolerance as to *Dothidella* resistance and, whenever possible, clones possessing both these characters were chosen. All these clones will, in due course, be distributed to all rubber producing countries in the Eastern hemisphere for research and experimental purposes.

Breeding for Phytophthora Tolerance:

The *Dothidella*-resistant clone F 4542 is the only *H. benthamiana* selection which combines tolerance to *Phytophthora* with resistance to *Dothidella*. It does not show the typical leaf-fall and stem-lesion phases of *Phytophthora* but may under certain conditions favourable to the fungus show some injury to immature leaf and green stem tissues.

It is a fact that every *Dothidella*-resistant clone tested in tropical America may suffer from tip injury when exposed to a heavy *Phytophthora* inoculum during prolonged periods of cool wet weather. The best of these clones are therefore considered tolerant rather than highly resistant or immune to *Phytophthora*.

A number of hybrid F_1 clones with F 4542 as a parent also show a high degree of tolerance to *Phytophthora* (Manis, 1954). Of these the most important would appear to be IAN 45-717 (PB 86 × F 4542), a good yielder for an F_1 hybrid clone, giving 12 lb. per tree per year in the twelfth year of age on the S/2,d/2,100% tapping system in Costa Rica.

Among the best top clones for crown budding at Belterra, Brazil, some or all of which may be tolerant to *Phytophthora*, are FX 2784, 3810, 3899, 3925 (of the cross F 4542 × AV 363), and FX 3482, 4037 (of the cross F 4542 × PB 86).

These clones and clones IAN 45-717, FX 590, 614, 617, 637 and 645 which show a high degree of tolerance to *Phytophthora* at Los Diamantes, Costa Rica, are available in Ceylon, providing *Phytophthora*-tolerant material for use in breeding work.

All these clones derive factors for *Dothidella* resistance and *Phytophthora* tolerance from F 4542, a clone which should play an important part in any breeding programme where resistance to these two diseases is of primary importance.

Of the *Dothidella*-resistant clones listed in Tables 1 and 2 all the Ford *H. brasiliensis* selections, all the *H. benthamiana* selections with the exception of F 4542, and all the pure *H. brasiliensis* crosses with the exception of IAN 45-873 are susceptible to *Phytophthora*.

Clone IAN 458-73, the highest yielding *Dothidella*-resistant clone in Costa Rica, (Langford, 1957) is somewhat susceptible to the leaf-fall phase of *Phytophthora* but not to panel infection or branch canker.

All other *H. benthamiana* selections, numbering about seventy, are susceptible to *Phytophthora* to a greater or lesser degree. Clone F 4537, a *Dothidella*-resistant *H. benthamiana* selection which has also been extensively used in crosses with Eastern

clones, and at least two of its progeny, clones IAN 586 and 588, are known to be extremely susceptible to *Phytophthora*. F 4537 is not therefore represented as the *Dothidella*-resistant parent in any one of the clones of the first and second backcross to the Eastern parent imported into Ceylon.

Stations for testing resistance to *Phytophthora palmivora* and to *Oidium heveae* have been established in selected areas of Ceylon where climatic conditions are highly favourable for the development and spread of these fungi and most of the imported *Dothidella*-resistant clones are represented there.

Breeding for Dothidella Resistance:

The factors for *Dothidella* resistance in *Hevea* breeding in the Western hemisphere are derived from *H. benthamiana* selections, mainly clone F 4542, and from some Ford *H. brasiliensis* selections which have shown immunity from 1940 to date. Some *H. brasiliensis* selections from the Belém area and from the upper reaches of the Amazon, the FB and F clones, are only partially resistant to *Dothidella*. A few selections of Belém origin once thought to be resistant have succumbed to *Dothidella* in recent years, others such as B 110 continue to show a fairly high degree of resistance.

The Ford *H. brasiliensis* selections F 211, 409 and 1619 which had previously been resistant to *Dothidella* suffered some damage from the fungus at Belterra in 1946, when the rainfall was unusually high during the period of refoliation following wintering.

Some of the straight *H. brasiliensis* crosses which appeared to be *Dothidella*-resistant under Brazilian conditions have exhibited varying degrees of susceptibility under the optimum conditions for the development of the fungus which exist in Costa Rica, at Turrialba and Los Diamantes. Examples of such clones are FX 2261, 3844, and 3846. No pure *Dothidella*-resistant *H. brasiliensis* clone is now regarded as suitable for repeated backcrossing, because when crossed with high-yielding Eastern clones they give few resistant progeny and even these have not a high degree of resistance.

On the basis of disease resistance and vigour the F_1 hybrid progeny of F 4542 are clearly superior to those of F 4537, *e.g.* FX 2901, 2904, 4421, 4425, which on backcrossing give fewer resistant progeny.

Many of the *Dothidella*-resistant F_1 hybrid selections of the cross F 4542 with Eastern clones have been backcrossed and outcrossed to the Eastern parents at Belterra, Brazil as from 1942. Some of these F_1 families have transmitted *Dothidella* resistance to more than 50% of the BC_1 or OC_1 progenies.

In the second backcross, BC_2 (BC_1 backcrossed to Eastern) 10% of the progeny have shown resistance to *Dothidella* when the F_1 is an interspecific hybrid between the *H. benthamiana* clone F 4542 and an Eastern clone.

The consistent high level transference of *Dothidella* resistance by F 4542 to its progeny is well brought out in the above examples.

All *H. benthamiana* hybrids, other than FX 4360 (PB 86 × F 4155), FX 4421 (F 4537 × PB 86) and FX 4425 (F 4537 × PB 86), are rated as very highly resistant to *Dothidella*.

All progeny of F 4542 have hitherto been highly resistant but a recent report, which awaits confirmation, claims that some FX and IAN clones of F 4542 parentage have been found to be susceptible to *Dothidella* in Costa Rica.

The apparent breakdown of resistance in previously resistant material may be due either to climatic effects or to the appearance of new virulent races of the fungus which attack clones originally found to be resistant.

The occasional wide variation in the results of resistance tests conducted on the same material at various localities has been attributed to differences in strains of *Dothidella ulei* (LANGFORD, 1953).

Fundamental studies of the pathogen and of the genetic basis of host-parasite relationships which are to be undertaken in Trinidad by the Rubber Research Institute of Malaya may provide an understanding of the mechanism of *Dothidella* resistance in *Hevea* and so facilitate successful breeding.

The question of the evolution of new virulent physiological races of the fungus must constantly be kept in mind since it could completely upset a carefully planned scheme of breeding for resistance.

Methods of protection against such eventualities would emphasize the need to diversify the basic material by the utilization of new sources of resistance as genotypes.

The only available alternative to the *H. benthamiana* clone F 4542 would seem to be clones of H. *pauciflora*.

Some eight *H. pauciflora Dothidella*-resistant selections had been made by Townsend prior to 1959, since when he has introduced into Belterra 16 further *H. pauciflora* selections from Borda on the Machado river (TOWNSEND, 1957).

Seedlings of the cross P10 × PB 86 made at Belterra in 1955 provide an excellent example of hybrid vigour in *Hevea*. The seedlings were photographed in a *Dothidella* testing nursery in Belterra and the full complement of plants in the row provides convincing evidence of the high degree of resistance in this family.

This uniformity in type and the high degree of hybrid vigour suggest a highly inbred line of the *H. pauciflora* parent. At one year of age these seedlings ranged from 8 to 13 feet in height, or about double the height of seedlings of other crosses made in the same year.

This vigour of growth may decrease with the subsequent backcrosses on to the same Eastern (*H. brasiliensis*) clone. However if at the second or third backcross level better clones than used in the original crosses are available their use in place of the recurrent parent would be desirable as reduction in vigour may be avoided. The purpose of backcrossing is to inbreed as rapidly as possible for certain yield genotypes which exist in the Eastern clones and at the same time select for *Dothidella* resistance. Such inbreeding will almost certainly cause a reduction in vigour as compared to the F_1 hybrid, but the Eastern clones are high yielders while most of the hybrids are not. It would be interesting in this connexion to cross BC_2 selections in an attempt to regain vigour.

Breeding Method:

The system of breeding to be followed consists in backcrossing a disease-resistant but low-yielding *Hevea* clone to a high-yielding Eastern clone with the object of transferring the factor for disease resistance to the Eastern clone without altering its desirable characteristics.

This backcross method of breeding is most useful and rapid for transferring a single character, which can readily be identified, from one variety to another variety which has many desirable characters. It consists in repeatedly backcrossing progenies of successive generations to the parent with desirable characters (the recurrent parent) and rigidly selecting in each generation only those plants that have inherited the desired single character from the donor parent (BRIGGS AND ALLARD, 1953).

The final objective is to produce progeny with disease resistance and a yield potential approaching or equalling that of the recurrent parent.

A character determined by a single dominant gene which is simply inherited is the easiest to transfer and it affects the recurrent parent only in respect of that character. If the character is polygenically determined the task of combining it with high yield may present difficulties in a backcross programme.

Townsend and others have demonstrated in crosses and backcrosses that a 'worthwhile intensity' of resistance to *Dothidella* can be retained and that this character may be simply inherited. The high level of resistance to *Dothidella* they have obtained in BC_1 and BC_2 progeny provides evidence that *Dothidella* resistance can be retained in a backcross programme, although the genetics of *Dothidella* resistance have not been worked out.

Furthermore the apparent absence of linkage between the factors for *Dothidella* resistance and for yield is shown by a comparison of the yields of F_1 progenies of interspecific and intraspecific crosses, the mean yield of which is of the same order as the yield of their low-yielding Eastern parents (TYSDAL AND RANDS, 1953).

The yields of some hybrid F_1 selections, FX 3810, 3925 and IAN 45-717, are considerably higher and approach those of their high-yielding Eastern parents.

Clones made from *Dothidella*-resistant progenies of the first backcross to Eastern clones and established in the Western hemisphere were expected to come into tapping sometime in 1960. The early yield results of these BC_1 clones will be awaited with great interest.

Full advantage will be taken of the results of breeding work on *Hevea* carried out by Townsend in Brazil, represented in Ceylon by twenty-one clones of the first backcross (BC_1), thirty-one clones of the first outcross (OC_1) and twenty clones of the second outcross (OC_2) to the Eastern parent.

The *Dothidella*-resistant clones of more advanced breeding will be backcrossed to the same Eastern clone as previously and will also be crossed with the best RRIC clones and with the best of the 'exchange' clones received in 1954 from Malaya, Indo-China, Java and Sumatra, as soon as flowers are produced on buddings of the imported DR clones.

In this connexion, experiments on inducement of flowering in young budded plants are in progress and preliminary results have been reported by DE SILVA AND CHANDRASEKERA (1959). Production of viable pollen by 2 to 3-year-old plants would considerably hasten the backcross breeding programme. With this object in view *Dothidella*-resistant clones have been top budded on 3-year-old seedling plants

growing in the Eastern region of Ceylon where the *Hevea* main flowering season occurs in May and June, instead of February and March as is the case in the main rubber growing districts of the Western side of the Island, thus permitting the realization of two breeding seasons each year.

Dothidella Testing Station:

The breeding work envisaged will result in progenies of successive backcrosses and outcrosses, the reaction of which to South American Leaf Blight cannot be tested in the Eastern hemisphere where the disease is not present.

A standard procedure has been worked out in the Western hemisphere for tests of *Dothidella* resistance. Budwood material would be sent from the East for establishment in special test nurseries in which a high intensity of *Dothidella* inoculum is built up by the use of susceptible Eastern material grown in close proximity to the test clones through at least one rainy season.

The clones are then classified for *Dothidella* resistance using the two criteria of amount of leaf injury and of spore production, as defined by LANGFORD (1945).

It is important, therefore, that the necessary arrangements be made without delay for this material to be tested at some suitable centre in the Western hemisphere where the climatic conditions are highly favourable for the growth and development of virulently active strains of the fungus, and where a suitable organization exists for the conduct of the tests. Brazil and Guatemala are not as suitable for that purpose as Costa Rica. In Costa Rica the best climatic centre for screening for *Dothidella* and for *Phytophthora* is undoubtedly Turrialba which is located at 1800 feet elevation in a mountain valley on the Eastern (Atlantic) side of the Central Cordillera.

The climate of Turrialba is wet all the year round with an average of 231 wet days a year. The average yearly rainfall over the period 1944 to 1953 was 105.83 inches with a minimum of 2.66 inches in March and a maximum of 13.47 inches in December (BATCHELDER AND COEN, 1955).

Turrialba is linked by road (40 miles) and by railway (48 miles) to the capital San Jose and possesses the necessary technical facilities at the former U.S.D.A. Regional Research Station of La Hulera.

The Turrialba climate is also ideal for the development of *Phytophthora* which may at times constitute there as serious a problem as *Dothidella*. As far as Ceylon is concerned, therefore, Turrialba would provide the best location in the Western hemisphere for a disease testing station.

The writer had occasion in December 1957 to discuss this matter of a testing station in Turrialba with the Director of the Instituto Interamericano de Ciencias Agricolas (Inter-American Institute of Agricultural Sciences) and with the Project Leader, Coffee and Cacao Technical Services, who expressed willingness to co-operate in such a Scheme.

Need for International Co-operation:

Joint action by all Natural Rubber producing countries is required to solve this most important problem and it may be necessary to make a concerted approach to the Food and Agriculture Organization of the United Nations for assistance in the implementation of the scheme which could be financed by contributions from interested FAO member countries and industrial organizations.

The need for international co-operation in the field of *Hevea* production research is, in the author's opinion, a very real one and free exchange of ideas as well as of planting material is necessary if, amongst other benefits, the combination of high yield and disease resistance in *Hevea* is to be brought about in a relatively short time as an insurance against the future.

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TABLE 1.

Dothidella-resistant Clones imported into Malaya during 1953/1954 and introduced into Ceylon during 1955.

Clone	Origin
F 351	*H. brasiliensis* selection of Acre origin
F 406	,,
F 409	,,
F 1168	,,
F 1619	,,
F 1638	,,
F 4506	*H. benthamiana* selection of Rio Negro origin
F 4537	,,
F 4542	,,
FB 3300	*H. brasiliensis* selection of Belém origin
FB 3363	,,
FX 25	F 351 × AVROS 49 (false)
FX 232	F 351 × PB 186
FX 273	,, × ,,
FX 360	F 4542 × AVROS 363
FX 516	,, × ,,
FX 617	F 4542 × Tjir 1
FX 636	,, × ,,
FX 652	,, × ,,
FX 664	,, × ,,
FX 714	F 315 × AVROS 183
FX 2784	F 4542 × AVROS 363
FX 2831	F 4542 × Tjir 1
FX 4037	F 4542 × PB 86
FX 4421	F 4537 × PB 86

TABLE 2.

Dothidella-resistant Clones introduced into Ceylon in 1957 from the U.S.D.A. Plant Introduction Station, Miami, Florida.

Clone	Parentage
FX 349	F 4542 × Tjir 1
„ 505	F 4542 × AV 363
„ 567	„ × „
„ 590	„ × „
„ 614	F 4542 × Tjir 1
„ 645	„ × „
„ 1042	F 1425 × PB 186
„ 2261	F 1619 × AV 183
„ 3482	F 4542 × PB 86
„ 3899	F 4542 × AV 363
„ 4098	PB 86 × B 74
IAN 45-710	PB 86 × F 409
„ 45-713	„ × „
„ 45-717	PB 86 × F 4542
„ 45-873	PB 86 × FA 1717
IAN 2664	FX 4068 (F 4542 × PB 86) × PB 86
„ 2867	FX 516 (F 4542 × AV 363) × PB 86
„ 2877	„ × „
„ 2887	„ × „
„ 2890	FX 2831 (F 4542 × Tjir 1) × PB 86
„ 2892	„ × „
„ 2903	FX 516 (4542 × AV 363) × PB 86
„ 2904	„ × „
„ 2923	„ × „
„ 2928	„ × „
„ 3434	FX 4371 (F 4542 × PB 86) × PB 86
„ 3457	Tjir 1 × FX 652 (F 4542 × Tjir 1)
„ 3460	„ × „
„ 3646	FX 516 (F 4542 × AV 363) × Tjir 1
„ 3702	FX 4371 (F 4542 × PB 86) × PB 86
„ 3711	„ × „
„ 3714	„ × „
„ 3763	„ × „
„ 3787	FX 516 (F 4542 × AV 363) × Tjir 1
„ 3793	„ × „
„ 3795	„ × „
„ 3803	FX 567 (F 4542 × AV 363) × PB 86
„ 3819	FX 617 (F 4542 × Tjir 1) × Tjir 1
„ 3827	FX 516 (F 4542 × AV 363) × AV 363
„ 3828	„ × „
„ 3892	FX 617 (F 4542 × Tjir 1) × Tjir 1
„ 3893	„ × „

TABLE 3.

Dothidella-resistant Clones of the Second Backcross to Eastern Clones, introduced into Ceylon during 1959 from the U.S.D.A. Plant Introduction Station, Miami, Florida.

Clone	Parentage
IAN 6163	FX 43-443 (PB 86 × FX 2251 (F 4542 × AV 183)) × Tjir 1
,, 6165	FX 43-448 (PB 86 × FX 2251 (F 4542 × AV 183)) × Tjir 1
,, 6166	,,
,, 6167	,,
,, 6497	IAN 2818 (FX 516 (F 4542 × AV 363) × PB 86) × PB 86
,, 6499	,,
,, 6500	,,
,, 6584	FX 43-651 (FX 213 (F 4542 × AV 183) × AV 183) × PB 86
,, 6585	,,
,, 6586	,,
,, 6587	,,
,, 6640	FX 43-655 (FX 213 (F 4542 × AV 183) × AV 183) × PB 86
,, 6641	,,
,, 6645	,,
,, 6753	PB 86 × IAN 2814 (FX 516 (F 4542 × AV 363) × PB 86
,, 6754	,,
,, 6755	,,
,, 6756	,,
,, 6757	,,
,, 6834	FX 43-443 (PB 86 × FX 2251 (F 4542 × AV 183)) × AV 49 (false)

TABLE 4.

Dothidella-resistant Clones introduced into Ceylon during 1958/59 from the Firestone Plantations Company, Harbel, Liberia.

Clone	Parentage
FX 637	F 4542 × Tjir 1
,, 3810	F 4542 × AV 363
,, 3925	,, × ,,
,, 4065	F 4542 × PB 86
IAN 2321	PB 86 × FX 3993 (F 4542 × AV 363)
,, 2322	,, × ,,
,, 2328	,, × ,,
,, 2361	PB 86 × FX 4371 (F 4542 × PB 86)
,, 2363	,, × ,,
,, 2489	FX 4068 (F 4542 × PB 86) × Tjir 1
,, 2491	,, × ,,
,, 2570	,, × ,,
,, 2667	FX 4068 (F 4542 × PB 86) × PB 86
,, 2668	,, × ,,
,, 2744	FX 4068 (F 4542 × PB 86) × Tjir 1
,, 2750	,, × ,,
,, 2829	FX 516 (F 4542 × AV 363) × PB 86
,, 2833	,, × ,,
,, 2878	,, × ,,
,, 2879	,, × ,,
,, 2891	FX 2831 (F 4542 × Tjir 1) × PB 86
,, 2897	,, × ,,
,, 2900	FX 516 (F 4542 × AV 363) × PB 86
,, 2920	,, × ,,
,, 2921	,, × ,,
,, 2954	FX 4073 (F 4542 × PB 86) × PB 86
,, 2958	,, × ,,
,, 2960	,, × ,,
,, 2965	,, × ,,

Figure 1.

Eastern clones top budded

on left with Phytophthora tolerant clone IAN 45-717 (PB 86 × F 4542)

on right with H. brasiliensis Ford clones

Test 11. Los Diamantes, Costa Rica. 19-11-57.

Figure 2.

foreground—Defoliated H. brasiliensis Ford clone F 1619

background—Phytophthora-tolerant H. benthamiana clone F 4542 as crown on clone AVROS 49.

Test 13. Los Diamantes, Costa Rica. 19-11-57.

Figure 3.

centre—Phytophthora-tolerant clone FX 637 (F 4542 × Tjir 1)

right—H. brasiliensis Ford clone F 1620 as crown on clone AVROS 49

Test 12. Los Diamantes, Costa Rica.

19-11-57.

Figure 4.

centre—Phytophthora-tolerant clone IAN 45-717 planted 1946

right and left—Phytophthora-susceptible H. brasiliensis Ford clones as tops on Eastern clones.

Test 12. Los Diamantes, Costa Rica.

19-11-57

Figure 5.

Near end of centre row
Closer view of Phytophthora-tolerant clone IAN 45-717

Test 12. Los Diamantes, Costa Rica.

19-11-57.

Figure 6.

Near end of left row. Crown buddings of H. brasiliensis clone IAN 45-873 (PB 86 × FA 1717) showing comparatively little defoliation by Phytophthora.

Background—Trees with heavy crowns are of the H. benthamiana clone F 4542.

Test 13. Los Diamantes, Costa Rica.

19-11-57.

Figure 7.

Buddings of a clone of H. benthamiana (F4542) × H. brasiliensis parentage, resistant to South American leafblight, in abandoned budwood multiplication nursery at the former U.S.D.A. Regional Research Station, Turrialba, Costa Rica.

22-11-57.

Figure 8.

Buddings of clone RRIM 608 decimated by South American leaf blight in the same nursery shown in figure 7. All Eastern clones in this nursery, including clone RRIM 501, were similarly affected.

Turrialba, Costa Rica.

22-11-57.

Figure 9.

centre—Seedlings of the cross Hevea pauciflora FP 10 × PB 86

left—Seedlings of the cross IAN 2816 × PB 86

right—Seedlings of the cross FX 652 × AVROS 49

Note hybrid vigour and high degree of Dothidella resistance in the progeny of the cross FP 10 × PB 86.

Dothidella test nursery at Belterra, Brazil.

7-12-57.

Figure 10.

Another view of seedlings of the cross FP 10 × PB 86

Dothidella test nursery at Belterra, Brazil.

7-12-57.

CUTTING OF BLANKET CREPE AND SOLE CREPE

By

K. F. Heinisch

Introduction:

The cutting of either blanket crepe or sole crepe to standard size is in many Ceylon rubber factories still a manual operation, but interest is being shown in the mechanization of this cutting process.

The standard size of blanket crepe specified by the brokers is not more than 18″ × 24″ and not less than 17″ × 22″. It is desirable that one standard size is always maintained between these limits and that blanket crepe from any one source conform to that size. The simplest and commonest method of cutting the blanket crepe is to cut single pieces with a wet knife. The size of the individual pieces is measured by means of a stick, or by a wooden board of the same size as the piece to be cut, or by some other marks on the cutting table. This procedure is rather laborious and results in irregular cuts and in deviations in the size of the individual pieces. An improvement is obtained by stacking about 5 to 10 or more whole blankets on a table and cutting by means of a long knife or a converted cross-cut saw. This operation is more effective but, if it is not carried out carefully, the blankets may be of irregular shapes.

Although uniformity in size of sole crepe is required by the market, and the cutting could be considered as one of the important operations in its manufacture, cutting is still very often carried out by hand with a knife, using a board or some frame for shaping the sheets. The commonest defects resulting from this method of cutting are irregular or waved edges.

Various mechanical sole crepe cutting devices have been constructed and more or less successfully used. There seems to be no really efficacious cutter on the market in Ceylon and different models and methods of operation have been observed on estates.

A brief description is given of some devices which have proved to operate satisfactorily on estates in Ceylon or in Indonesia. As it has not been possible to collect all the information available Managers and Superintendents having similar or other devices on their estates are kindly requested to inform the Institute of their particular designs, methods of operation and general experience.

Cutting of Blanket Crepe:

Machine cutting of blanket crepe has not proved to be very practicable. The most practical operation seems to be the "trough method" which consists in cutting with a converted cross-cut saw piles of blankets stacked in a special trough.

Details of the trough are given in Figure 1. It consists of a frame constructed of hard wood. The walls and the bottom of the frame are made from 1″ planks

having, at 18″ intervals, slits ½″ wide lined with aluminium or galvanized iron strips to protect the wood against damage by the saw, and to prevent contamination of the rubber with wood splinters. The side walls are reinforced with angle iron or strip iron. The length of the trough should not be less than that of the blankets, which is usually 7½ to 12 feet, so that the trough may have between 5 to 8 compartments of 18″ each. The two ends of the trough should extend by about 3″ from the end compartments, to enable the irregular edges of the blanket to be trimmed. To facilitate removal of the piles after cutting, the end panels of the trough are so constructed as to be removable. The blankets are piled in the 12″ deep trough and cut along the slits with a cross-cut saw, about 48″ long, which have had the teeth removed and provided with 2″ curved knife edges. To obtain a smooth cutting operation the modified saw should be moistened with a soap solution or with a 0.1% Teepol solution.

This "trough" method is successfully used in Indonesia for baling of sheet rubber since the introduction of the bare back bale packing and has occasionally been used for cutting remilled blankets in Sumatra.

Guillotine cutters:

Various models and sizes of hand and power-operated guillotine cutters for different materials are available and many designs with a suitable level of the knife could be used for cutting sole crepe either in length or in width or, in combination with another device such as a rotary knife cutter, for cutting it in length alone. A suitable lever guillotine cutting machine with screw-down clamp, adjustable gauge on back table and with diagonal action lever, is reproduced in Figure 2. (Model No. 25, T. Kendell & Sons, Ltd., London). A rather similar construction (Model No. 26, 16½″) is in operation on Hewagam Estate, Padukka.

A sturdy cutter of a simpler construction, which has been designed on Padukka Group, Padukka, consists of a heavy knife, 2 2/16″ broad, 38 1/16″ long and 9/16″ thick, mounted on a U-shaped metal frame which can be moved up and down on two iron bars. Two heavy spiral springs keep this frame in an upright position. By means of two eccentric wheels connected to a handle, the frame can be pressed down with considerable force. Adjustable marks on both sides of the cutting table ensure the maintenance of a correct size. Two to three sheets of sole crepe can be cut at the same time, requiring 3 to 4 cutting operations each time. The output of this guillotine sole crepe cutter is said to be about 2000 lb. sole crepe per day.

In a trial it appeared that two pieces of blanket crepe of average thickness could be cut in one operation. Some alterations to the dimensions of the cutting table and suitable adjustments of the distance of the knife from the table would make this guillotine cutter suitable for blanket crepe.

Rotary Cutting Machines:

Rotary cutters are designed for cutting sheety materials into strips, squares and oblongs, by means of knife edge cutters. A very practical and compact machine suitable for sole crepe is the power-operated Kendell Rotary Cutter, model 125 R, shown in Figure 3 and manufactured by Messrs T. Kendell & Sons, Ltd., London. This machine is built in 6 different sizes from 25½″ upto 72″ width and may, therefore, be used for cutting sole crepe in width as well as in length. A variable number

of cutters and adjustable spacers between the knives determine the number and width of the strips, and strippers between the knives prevent the material sticking to the knives.

A practical combination of this rotary cutter for shaping the sole crepe in width and of an adjustable guillotine (model No. 26. 16½", T. Kendell & Sons Ltd., London) for cutting it in length has been in operation on Hewagam Estate, Padukka for about 8 years and seems to be a most satisfactory device. The laminated blanket may be fed continuously between the rollers and comes out cut in the required width. The edges are straight. The blanket passes from the rollers on to a bench and is cut to the required length by means of a small, hand-operated guillotine.

At Dalkeith Group, Latpandura, a mechanical cutting device with rotating knives, having a capacity of approximately 2000 lb./hour, has been constructed and has been in use for several years. In this cutting device a motor driven shaft with two rotating blades is mounted on a metal frame. A carrier which can be moved on rollers over the frame and which can hold two to five sheets of sole crepe is kept in position by a covering plate. Both the carrier and the cover plate have two openings for the passage of the knives. The sole crepe is cut by pushing the carrier under the rotating blades which dip in water.

There are two operations necessary to shape the sole crepe, one for cutting it in length and one in width, each requiring a separate machine. This cutter is illustrated in Figure 4.

Hand cutters:

Hand cutters of quite a simple construction, operating on the principle of double shear cutters, are in use on several small estates in Java. Two knives are mounted on a frame fixed at one end of the cutting table. A heavy plank is attached between the knives and a counterweight holds the frame and plank in an upright position.

During the cutting operation the plank is pressed on the sole crepe, to keep it flat and in position, before the action of the knives starts. Two cutters, illustrated in Figures 5 and 6, are necessary to cut the sole crepe in length and in width.

Punching Devices:

Devices based on this system consist of four knives mounted on a suitable frame according to the size of the sole crepe and enable one or more sheets of sole crepe to be punched in one operation. The punching frame may be operated by means of a handpress to which it is attached or by two handles with spring systems or by a slow moving mechanical punching press. It is essential that the punching frame be fitted on the inside with an extending plank fixed on springs, to keep the sole crepe in a flat position.

The hand-operated punching press, shown in Figure 7, is being used satisfactorily on several estates in Java and in Sumatra.

In co-operation with the Rubber Research Institute of Ceylon, Messrs Brown & Co., Ltd., Colombo, have designed a handle-operated punching device, which is still in an experimental stage. The results of the experiments to test the performance of this device will be published later.

Acknowledgements:

Acknowledgement is made to the Manager of Dalkeith Group, to the Superintendents of Padukka Group and Hewagam Estate, to Messrs. T. Kendell & Sons, Ltd. London, and to the Indonesian Rubber Research Institute, Bogor, for valuable information.

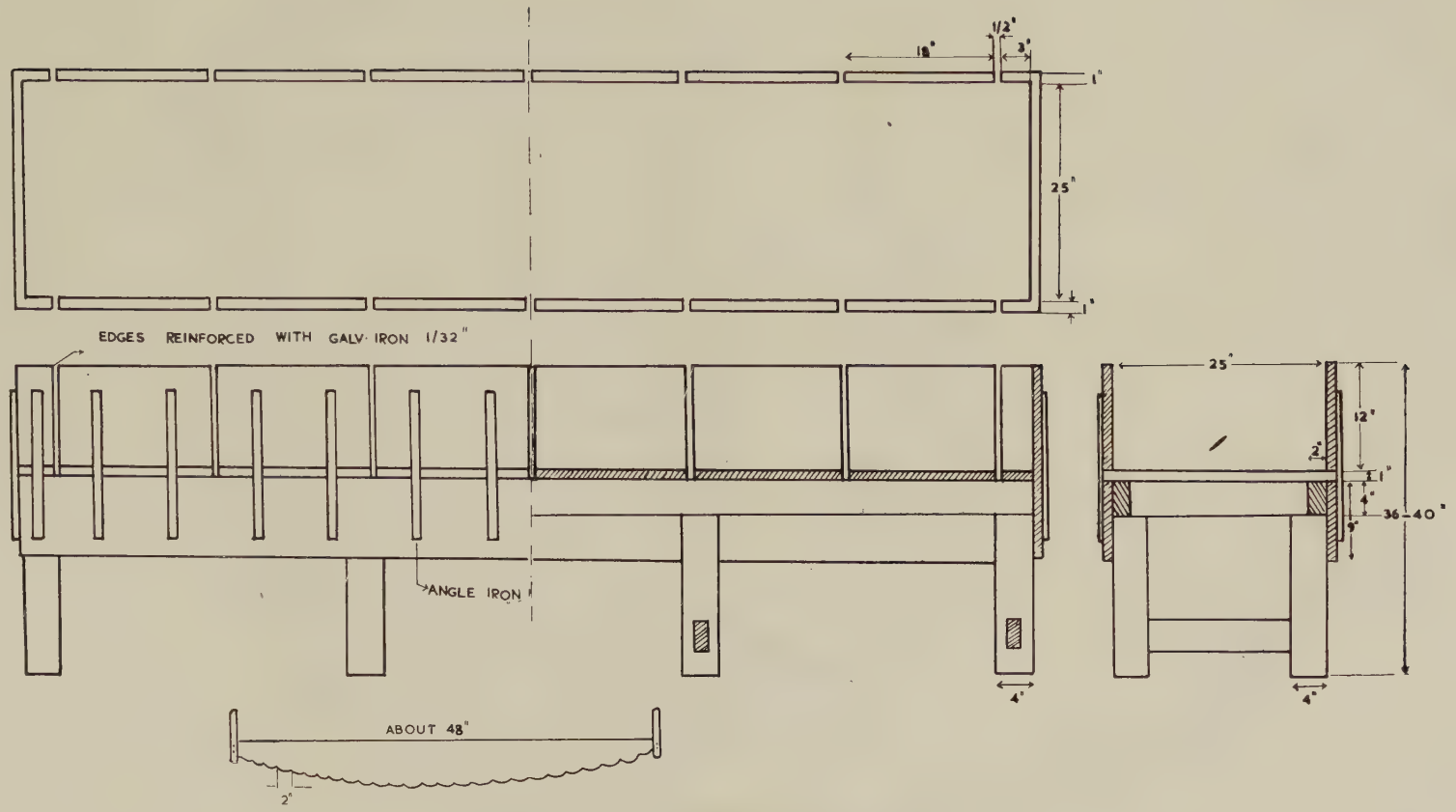

Figure 1: Trough for cutting of Blanket Crepe.

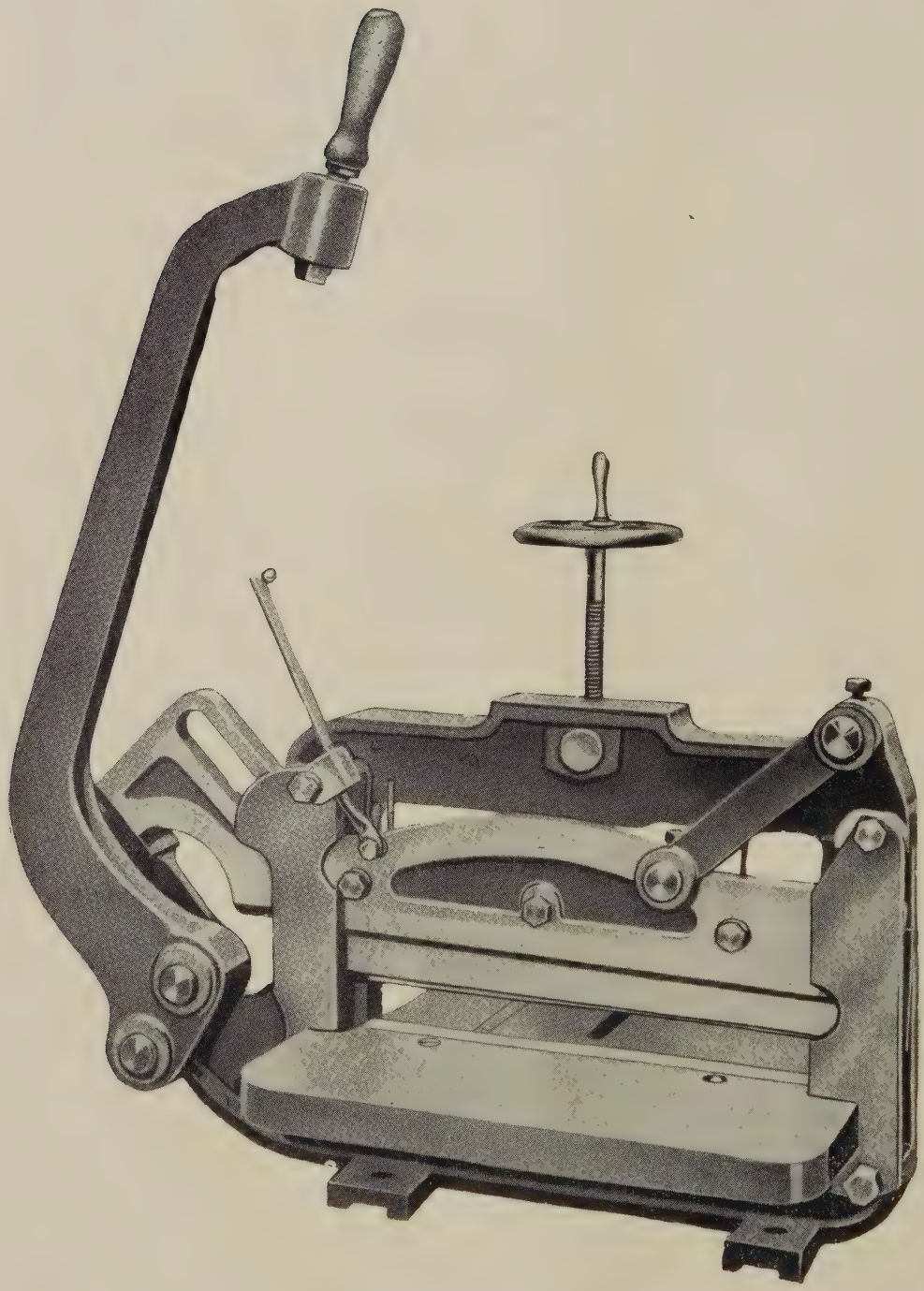

Figure 2: Lever guillotine cutting machine. Model No. 25, T. Kendell & Sons Ltd., London.

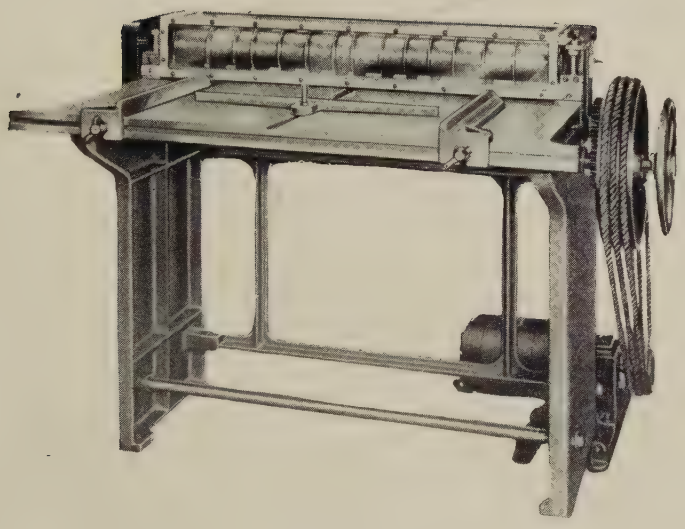

Figure 3: Rotary cutting machine Model No. 125R, 38″ width.
T. Kendell & Sons, Ltd., London.

Figure 4: Rotary cutter on Dalkeith Group for cutting sole crepe in width.

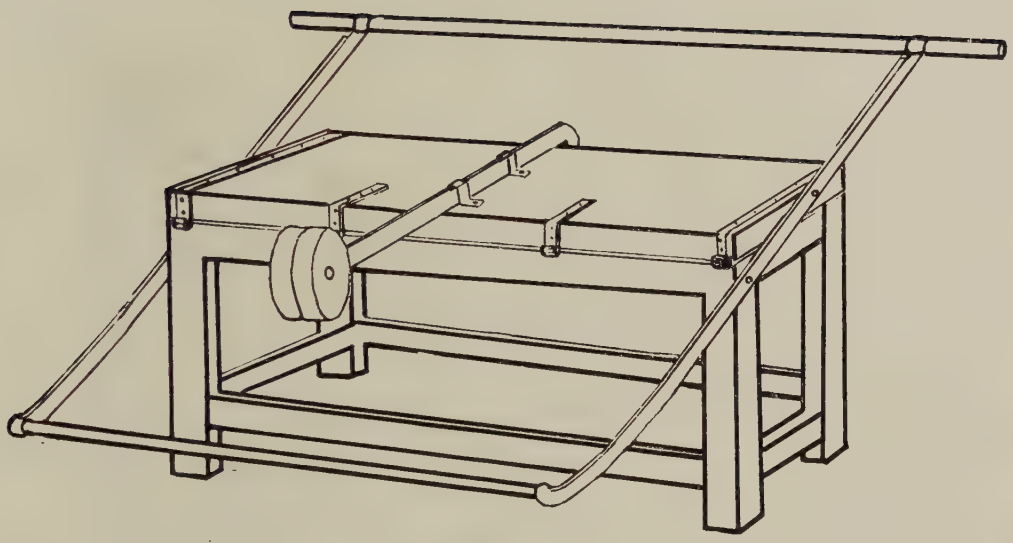

Figure 5: Sketch of a simple hand cutter used in Java.

Figure 6- Simple hand cutters for Sole Crepe used in Java.

Figure 7: Punching press used in Java and Sumatra.

TABLE 1.

District	Acreage		Holdings	
	1958/59	1959/60	1958/59	1959/60
Kalutara ...	1669½	2091¾	473	608
Colombo ...	1360¼	1548½	455	491
Kegalla ...	1248½	1846¼	521	797
Ratnapura	856¼	1297¾	229	360
Galle ...	731¾	808¾	127	139
Matara ...	310	514¼	37	70
Kandy ...	70½	67¾	42	39
Total ...	6246¾	8175	1884	2504

The number of co-operative dusting groups had therefore to be increased to cope with the enlarged scheme. (Table II & Annexure II).

TABLE II

Distribution of Dusting Groups		
District	No. of Groups 1958/59	No. of Groups 1959/60
Kalutara ...	17	20
Colombo ...	14	15
Kegalla ...	15	20
Ratnapura ...	9	13
Galle ...	8	8
Matara ...	3	5
Kandy ...	1	1
Total ...	67	82

As in previous years the largest acreage to be dusted in a single district was in Kalutara, where 2091¾ acres were dusted as against 1669½ last year. Kandy district had the smallest acreage this year too. In fact, it was with great difficulty that the Department was able to organize a group in Kandy district this year, and it appears rather doubtful whether it would be possible to expand the Scheme in this district in the near future owing to the apathy of the smallholders. This is regrettable because Oidium is endemic in that district.

Dusting Operations:

Wintering was later than usual and defoliation was uneven. In certain cases dusting operations were slightly affected by passing showers and unsettled weather conditions which prevailed during the latter part of the season.

In all dusting groups Rubber Instructors were required to personally supervise dusting operations during the first and second rounds. Subsequent rounds of dusting were supervised as other duties permitted. Holdings in the Kegalla District were the ones which were ready for dusting first. Dusting operations were commenced on 16-1-60 in the Etnawala and Pandeniya groups. Then followed the Mandawala and Undugoda groups. The first co-operative group to complete dusting was the one organized at Etnawala where the final round of dusting was completed on 2-3-60. The dusting operations for the season were concluded on 7-4-60, when the last few holdings in the Malwala group (Ratnapura Division) were given the 5th round of dusting.

Results:

It is gratifying to place on record the successful protection against Oidium infection of holdings which participated in the Co-operative Sulphur Dusting Scheme.

Whilst undusted holdings were infected fairly severely by Oidium, the dusted ones generally escaped attack. In a very few cases only a slight amount of infection was noticed in the dusted holdings.

Summary:

Number of holdings dusted	2,504
Acreage dusted	8,175
Number of groups which functioned	82
Number of machines used	94
Acreage per machine	86½
Average size of a holding	3¼ acres
Size of the smallest holding	¼ acre
Size of the largest holding	31 acres
Average number of holdings in a group	30

The total of 8175 acres dusted in 1959/60 constitutes the largest extent of smallholdings to be dusted against Oidium in one season.

The smallest holding to be dusted was only ¼ acre in extent. On an average there were 30 holdings to a group, as opposed to 28 in the previous year. In all 6035 acres in budded rubber, 926¾ in clonal seedling rubber and 1213¾ acres of ordinary high yielding rubber were dusted (Annexure 3). Of the total acreage 73% were provided with subsidized sulphur dust. The vast majority of the members had actually joined the Scheme on account of the sulphur being made available to them at half the cost. The attached charts (I & II) summarize the dusting work in 1959/60.

Follow-Up:

In order to ascertain the position in dusted and undusted rubber holdings after a period of time, Rubber Instructors were requested to re-inspect and report on these areas. The results obtained are tabulated in Chart III.

This comprehensive follow-up survey covered all holdings which had been sulphur dusted during the previous season and showed that the dusted holdings continued to maintain their superiority over the undusted ones. The success of the Scheme is apparent from the fact that over 98% of the smallholders have expressed their willingness to join in the Scheme in the following season as well.

Acknowledgements:

The successful formation of the co-operative dusting groups and the smooth working of the Sulphur Dusting Scheme throughout the season was entirely due to the efforts of the field and office staff. Their assistance in making this Scheme a success is gratefully acknowledged.

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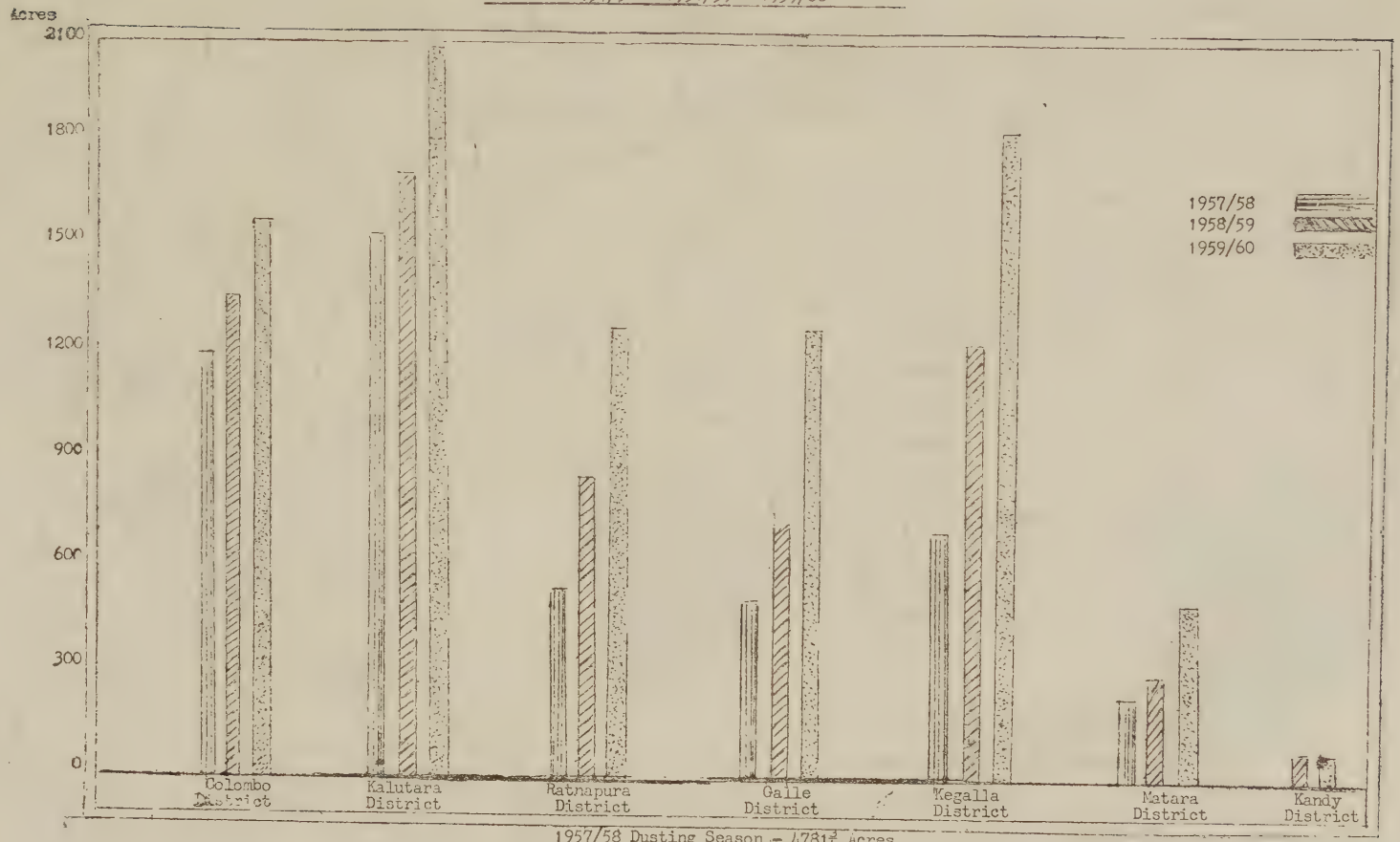
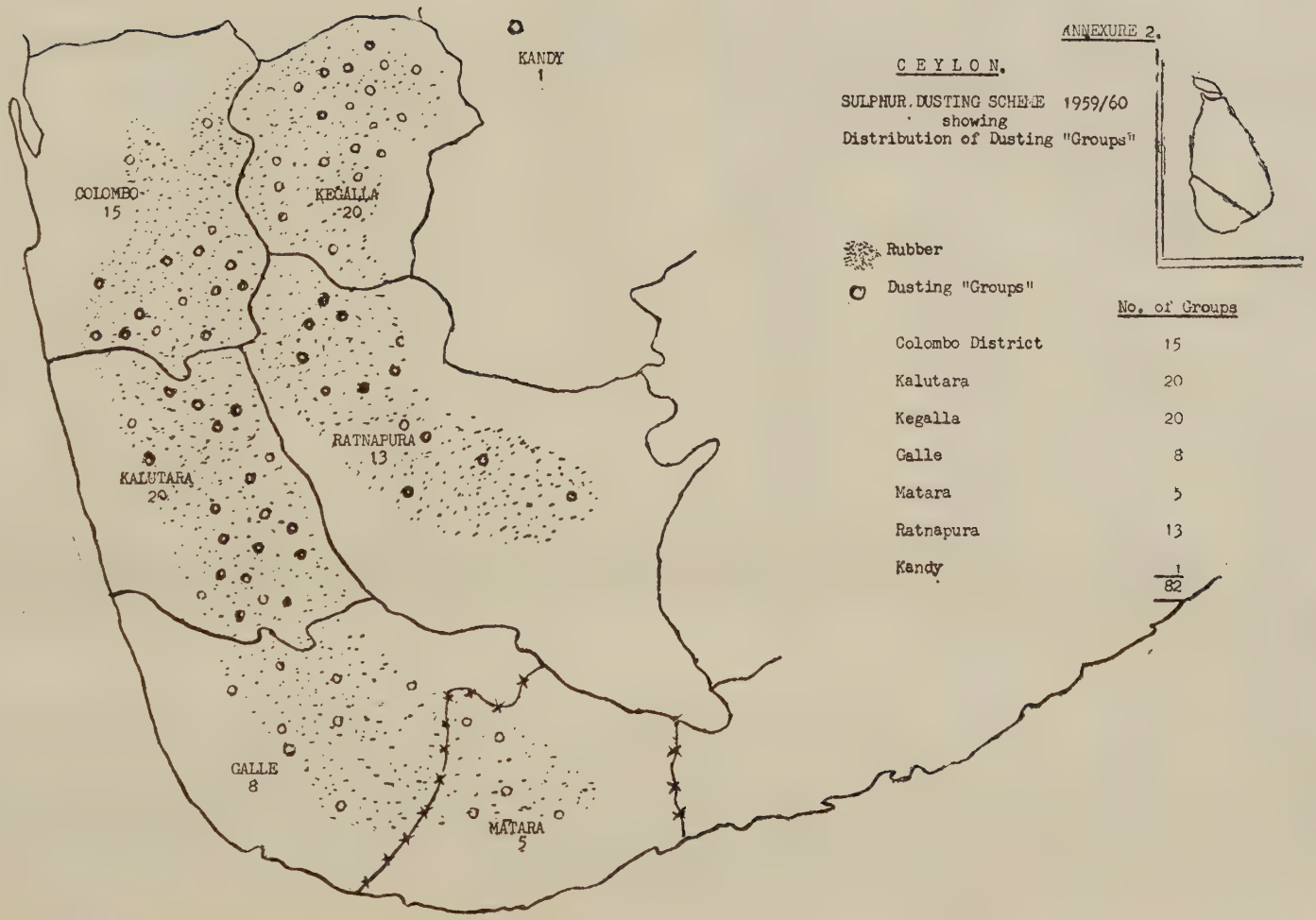
PROGRESS IN SULPHUR DUSTING OF SMALLHOLDINGS
1957/58 - 1958/59 - 1959/60

ANNEXURE 1.



1957/58 Dusting Season - 4781¾ Acres
1958/59 -do- - 6246¾ "
1959/60 -do- - 8175 "



ANNEXURE 2.

C E Y L O N.

SULPHUR DUSTING SCHEME 1959/60
showing
Distribution of Dusting "Groups"

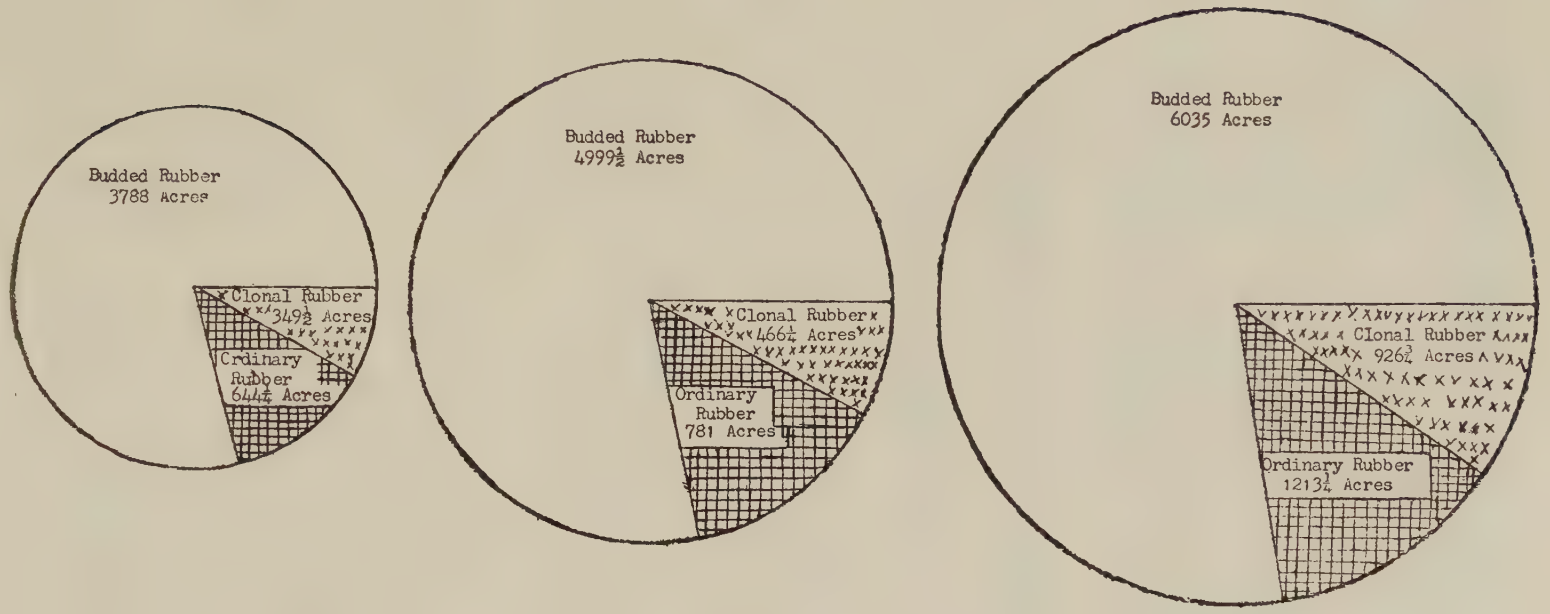
Rubber

Dusting "Groups"

	No. of Groups
Colombo District	15
Kalutara	20
Kegalla	20
Galle	8
Matara	5
Ratnapura	13
Kandy	1
	82

ANNEXURE 3.

RUBBER ACREAGES SULPHUR-DUSTED - CLASSIFIED ACCORDING TO KIND OF RUBBER



1957/58 - 4781¾ Acres

1958/59 - 6246¾ Acres

1959/60 - 8175 Acres

PLANTING TOPICS

Tapping for Increased Yields with the Use of Rainguards

Rainguards have in the past been used solely to increase the number of normal tapping days by protecting the tapping panels of rubber trees from wetness during monsoon periods, when continuous wet weather prevents the drying out of tapping panels for the tapping operation which normally starts before sunrise and is completed in about four hours.

Large-scale field experiments have recently been initiated on a number of commercial estates under the guidance of the Rubber Research Institute of Ceylon to determine the general economics of increased production with the use of rainguards. Types of rainguards made of 'polythene' film or of rubber are shown in Figures 1 to 4.

It is hoped that certain types of rainguards will also help to prevent or minimize the incidence of bark diseases caused by *Phytophthora palmivora* as the pathogen causing these bark diseases is a motile zoospore which can only survive under moist conditions. This Institute is also carrying out field experiments with rainguards as a possible means of preventing or reducing copper contamination of latex by copper dust used for the control of *Phytophthora* leaf-fall.

The rainguards could normalize tapping on late tapping days, which may account for the loss of 20 to 25% of the crop on such days, and on partial 'washout' days when a part or the whole of the day's crop may be lost due to rain before latex collection. It should also be possible to tap on showery days when the tapping panel is kept dry with the use of rainguards, if the tappers are willing to work on such days.

An increase in the number of normal tapping days constitutes an increase in the 'actual' intensity of tapping, as indicated in Table I, by the number of full circumference cuts per tree per tapping year for both single and double-cut systems, while the 'relative' tapping intensity remains the same for a fixed number of tapping days on a particular estate, as indicated in the last column in Table I.

TABLE I

'Actual' and 'Relative' Tapping Intensity

Tapping System	'Actual' Intensity	No. of full-circumference cuts according to the number of tapping days per year				'Relative' intensity
		240	280	320	340	
(1) S/2, d/2, 100%	$\frac{1}{4}$ cut per day	60	70	80	85	100
(2) 2S/2, d/4, 100%	$\frac{1}{4}$ cut per day	60	70	80	85	100
(3) 2S/2, d/3, 133%	$\frac{1}{3}$ cut per day	80	93	107	113	133 (approx.)

The number of full-circumference cuts per tree per year gives a measure of the physiological strain on the tree in contributing to the year's crop.

At the present time the rainguards are used on a single half-spiral cut tapped on alternate days; it is however possible that rainguards may be used on double-cut systems as well.

The maximum number of full-circumference cuts, which can be adopted without adverse effects from increased yields can only be resolved with the practical experience gained from the use of rainguards over a period of years with various types of planting material growing under different conditions.

In the wet low-country districts with greatly reduced number of tapping days there is little likelihood of exceeding the safety limits of increased yields with the use of rainguards on 100 per cent intensity tapping systems.

High-yielding budded rubber which may yield well above 1500 lb. dry rubber per acre per year may present problems with regard to adverse effects from the use of rainguards, when the economic life span of the trees is taken into consideration.

While the need for increased yields is fully appreciated at the present time, certain aspects of obtaining increased yields with the use of rainguards cannot be overlooked.

In obtaining increased yields from rubber areas which are not to be replanted in the near future much depends on the agricultural practices which are required to keep the trees up to the correct standard of vitality for increased production. In Ceylon, where leaf-fall is caused by both *Oidium* and *Phytophthora* diseases, inadequate control of disease and the absence of systematic manuring could bring about a premature devitalization of the trees.

C. A. de S.

Figure 1.

Full circumference polythene skirt-type rainguard.

Figure 2.

Half circumference polythene apron-type rainguard.

Figure 3.

Apron-type polythene rainguard along angle of tapping cut.

Figure 4.

'CISIR' rubber rainguard.

QUESTION CORNER

Question:

Could you please let me know whether Bromo Cresol Green indicator paper could be used when oxalic acid is used for the coagulation of latex, and if not, would you kindly let me know the reason why?

Answer:

Bromo Cresol Green indicator paper, recommended for use with formic or acetic acid coagulation of latex, is not so effective with oxalic acid, especially for indicating an insufficiency of the acid. It should, however, show the presence of an excess of oxalic acid. Although considerations of molecular weights and dissociation constants indicate that equal amounts of formic acid and oxalic acid will change the pH value of latex to a similar extent, it is found in practice that the lowering of the pH of field latex (diluted to 2 lb./gallon) up to about pH 5, by equal amounts of the two acids is almost identical, but below a pH of 5 the formic acid coagulates the latex faster than does oxalic acid. When oxalic acid is used, the change of the acidity of the latex from pH 5 to the pH at which coagulation occurs is slow, and although the indicator paper shows a green colour, the amount of oxalic acid added may not be sufficient and more acid has to be added to cause the latex to coagulate. Hence for a proper coagulation with oxalic acid, the colour of the pH indicator papers do not match exactly that of the colour chart reproduced in our Advisory Circular No. 67 and the colour of the indicator paper after use should be a light greenish yellow instead of the darker yellowish green when formic or acetic acid is used for coagulation.

M. N.

Question:

Could you advise me on possible control measures against an insect which is cutting the polythene rainguards?

Answer:

The insect which is cutting the polythene rainguards and building nests in it has been identified as the Common Cricket Locust, *Diaphanogryllacris aequalis Walker*, also known as "Curtain slitters or cutters". It belongs to the family Tettigoniidae, sub-family Gryllacrinae.

This locust which is a common cause of damage to polythene rainguards has also been observed on Dartonfield Estate. From observations made it might be suspected that this damage and nest building occurs mainly during the breeding period of the insect.

A possible means of control may be provided by dusting or spraying with a suitable insecticide (*e.g.* Intox 8, Chlordane, Chlordox, Eldrin) the surroundings where these locusts are observed but this measure would only be effective if a large number of the locusts are present.

Our observations indicate, however, that their number is quite limited and that one locust may in one night damage several rainguards. Collection of the locusts by tappers early in the morning, when they are in their nests, would, in this case, be a more appropriate method of control.

We do not consider that treatment of the rainguards with an insecticide would be very effective as the insecticide would be washed off by rain.

As this locust appears sporadically, Superintendents of Estates are kindly requested to inform the Rubber Research Institute of Ceylon on their further observations regarding the behaviour of this insect and on their experience in controlling it so that the damage may be minimized or prevented altogether.

Photographs of the insect and of a damaged rainguard appear on the following page.

K. F.

Common Cricket Locust

Damaged rainguard

RUBBER RESEARCH BOARD

168th Meeting.

Minutes of the 168th meeting of the Rubber Research Board held at 10 a.m. on Friday, 22nd July, 1960 in the Board Room of Messrs. Aitken Spence & Co., Ltd., Lloyd Building, Prince Street, Colombo.

Present:—Mr. S. Pathmanathan (in the Chair), Mr. G. H. Carter, Mr. W. P. H. Dias J.P., Mr. W. B. Jonklaas, Senator L. Jayasundera, Mr. H. E. Peries (Deputy Secretary to the Treasury), Dr. E. D. C. Baptiste (Director) and Mr. C. D. de Fonseka (Chief Administrative Officer).

Mr. M. L. Wickremasinghe of Messrs. H. W. Hammond & Co. was present by invitation.

Mr. L. C. de Mel and Mr. B. Mahadeva (Rubber Controller) had intimated their inability to attend.

1. **Board:—Changes in Membership**—The Chairman welcomed:

    1. Mr. W. B. Jonklaas who had been nominated to serve as a representative of the Planters' Association of Ceylon during the absence on leave of Mr. H. Creighton with effect from 20th May 1960.

    2. Mr. A. V. Richards, Deputy Director of Agriculture, who had been appointed to act as Director of Agriculture with effect from 1st April 1960.

2. **Power Supply.**—Agreed that fresh tenders be called for the supply and installation of equipment in connection with the acceptance of Government A.C. electrical supply in accordance with the revised specifications prepared by the Visiting Engineers.

Mr. Wickremasinghe left the meeting and the Chairman thanked him for his assistance.

3. **Minutes:**

(*a*) *Confirmation.*—Draft minutes of the meeting held on 31st March 1960, which had been circulated to members, were signed by the Chairman.

(*b*) *Matters arising from minutes:*

1. Balance Sheet & Final Accounts for 1959.—A statement showing the building votes for 1958 and 1959 and the expenditure incurred thereon was considered and it was noted that almost all the items had been completed.

2. Senior Field Assistant, Nivitigalakele.—Reported that Mr. H. A. Mendis had been appointed Senior Field Assistant, Nivitigalakele, with effect from 1st August 1960.

4. **Administrative Committee.**—The recommendations made by the Committee at its meeting held on 6th May 1960 were approved and the following decisions were arrived at on the basis of these recommendations:

(*a*) *Visiting Engineer's Report.*—Agreed that the recommendations made in the report be given effect to.

(*b*) *Soils Chemist.*—Agreed that Mr. A. J. Jeevaratnam be confirmed as Soils Chemist with effect from 1st August 1960.

(*c*) *Plant Breeder.*—It was reported that Mr. R. T. Wijewantha, who had been appointed Plant Breeder, would shortly go to the University of California for a course of study leading to the Ph.D. degree, in accordance with arrangements made with the United States Operations Mission.

(*d*) *Sub-station at Kuruwita.*—Mr. B. Cocking of Rambukkanda Group, Ratnapura, was appointed to overlook the sub-station at Kuruwita.

(*e*) *Supply of Cookers to Staff.*—It was decided that subsequent loans for purchase of cookers may be given to the staff after the first loan is fully repaid and not less than 5 years after the grant of the first loan.

(*f*) *Smallholdings Department Office Premises.*—Agreed that the lease of premises No. 267/3, Galle Road, Bambalapitiya which is presently occupied by the Smallholdings Department be renewed for a further period of 2 years on the same terms and conditions.

(*g*) *Letter from R.R.I.C. Staff Club.*—The following requests made by the R.R.I.C. Staff Club were granted:

(i) The verandah of the Club House be enclosed by providing steel louvred windows for the bays.

(ii) The annual grant to the Club be increased to Rs. 1,250/-.

(*h*) *Purchase of Vibrating Road Roller.*—Agreed that a 32-inch vibrating roller be purchased for road making; a supplementary vote was passed for this purpose.

(*i*) *Assistant Administrative Officer, Head Office.*—The appointment of an Assistant Administrative Officer was approved.

5. **Estate & Experimental Committee.**—The recommendations made by the Committee at its meeting held on 3rd June 1960 were approved and the following decisions were arrived at on the basis of these recommendations:

(*a*) *Sub-station at Kuruwita.*—The arrangements made regarding the working of the sub-station were noted and approval was given for the following constructional work to be undertaken:

1. Bungalow for the Senior Field Assistant.
2. Smokehouse of 5,000 lb. capacity.
3. Curing shed, Engine room, Store, Tools and Manure shed and Office to be housed in one building.
4. One well, water tank and pump house.
5. Outlet Road to Kuruwita.
6. Temporary Curing Shed.

(*b*) *Estate Superintendent's Reports, January to March* 1960.—were approved.

(*c*) *Estate Accounts, January to March* 1960.—were approved.

6. **Smallholdings Committee.**—The recommendations made at the meeting held on 8th April 1960 were approved and 20 Temporary Rubber Instructors were confirmed in their appointments, as recommended by the Chief Advisory Officer Smallholdings.

7. **Smallholdings Selection Committee.**—The recommendations made at the meetings held on 8th April and 19th April 1960 were approved and on the basis of these recommendations 7 Temporary Rubber Instructors and one Mechanic were appointed to the Smallholdings Department.

8. **Selection Committee for the appointment of C.A.O.S.**—The recommendations made at the meeting held on 23rd June 1960 were approved and Mr. A. B. Dissanayake, B.Sc. Ag. (Cey) was appointed to the post of Chief Advisory Officer Smallholdings.

9. **Reports and Accounts:**

(*a*) *Report on visit to Malaya by Chief Advisory Officer Smallholdings.*—Mr. R. T. Wijewantha, Chief Advisory Officer Smallholdings, was thanked for the very useful report submitted by him in connection with his recent visit to Malaya.

(*b*) *Receipts and Payments Account for the 1st Quarter* 1960.—was approved.

10. **Staff**

(*a*) *Director.*—It was reported that the Director, Dr. E. D. C. Baptiste, would go on overseas leave in December 1960 for about 3 months.

(*b*) *Plant Pathologist.*—It was reported that the Plant Pathologist, Dr. A. Riggenbach, would go on 4 months end-of-contract leave in August or September 1961.

(*c*) *Chemist.*—It was reported that the Rubber Chemist, Dr. K. F. Heinisch, would go on 4 months end-of-contract leave in December 1960.

(*d*) *Chief Advisory Officer Smallholdings.*—The Chairman reported that Mr. R. T. Wijewantha had been awarded the M.Sc. (Lond.) degree.

(*e*) *Research Assistant, Chemistry & Botany Departments.*—The following promotions were authorised:

1. Mr. M. Nadarajah, Research Assistant Chemistry Dept., as Assistant Rubber Chemist with effect from 1st July, 1960.
2. Mr. L. B. Chandrasekera, Research Assistant Botany Dept., as Assistant Botanist with effect from 1st July, 1960.

(*f*) *Assistant & Minor Staff Changes.*—Changes in staff since the last meeting were reported and approved.

(*g*) *Loans to Officers for purchase of transport.*—Loans given to four officers for purchase of transport were reported and approved.

11. **General Matters:**

(*a*) *Natural Rubber Research Conference.*—The arrangements made for Dr. E. D. C. Baptiste, Director, Dr. K. F. Heinisch, Rubber Chemist, and Dr. A. Riggenbach, Plant Pathologist, to attend the Natural Rubber Research Conference in Malaya in September 1960 were noted.

(*b*) *Letter from S/A & L. re Scientific Advice & Research for Rubber Industry.*—This matter was considered and it was agreed to participate in the services of the panel of consultants (in replacement of the Agricultural Sub-Committee of the London Advisory Committee) and in the ancillary services which will be established in the office of the London Representative of the Malayan Rubber Fund Board.

(*c*) *Request from R.R.I.C. Staff Club.*—A request from the R.R.I.C. Staff Club for a special grant for participation in the Kalutara District Cricket Tournament was approved.

12. **London Advisory Committee.**—Minutes of the 14th meeting of the Agricultural Sub-Committee held on 21-1-1960 were tabled.

13. **Publications.**—The following publications were tabled:

(*a*) Annual Report for 1959

(*b*) 3rd Quarterly Journal 1959

(*c*) 4th Quarterly Journal 1959.

(*d*) Advisory Circular No. 67—A Simple Method of Control of Latex Coagulation

(*e*) Smallholdings Folder No. 6—Tapping (English & Sinhalese)

—do— No. 7—Phytophthora Leaf Fall (English & Sinhalese)

—do— No. 8—Bark Rot & Canker (English & Sinhalese).

14. **Next Meeting.**—Agreed that, as already arranged, the next meeting of the Board be held at 10 a.m. on 28th October 1960.

15. **Any other bisiness:**

(*a*) *Crepe Drying Tower.*—The award of a contract to Messrs. Brown & Co., Ltd., for the construction of a Crepe Drying Tower at Dartonfield was authorised subject to a reduction in their tender figure.

(*b*) *Construction of 2 wells at Dartonfield.*—Agreed that a contract be awarded to Mr. M. S. Fernando for the construction of 2 wells at Dartonfield, if his credentials are satisfactory.

(*c*) *Letter from Minor Staff.*—A letter from 33 members of the Minor Staff requesting that they be granted loans for the purchase of push bicycles was considered and the request was granted.

The meeting then terminated.

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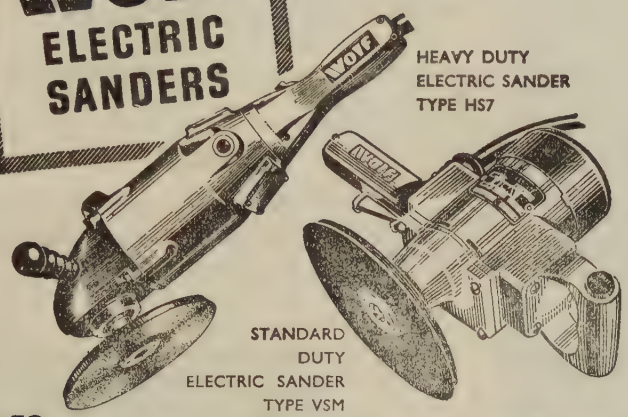

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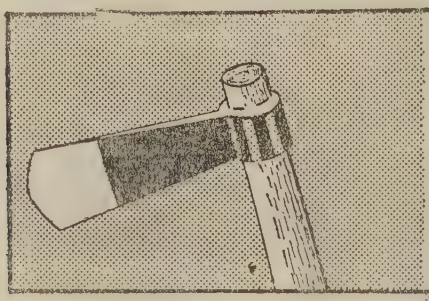

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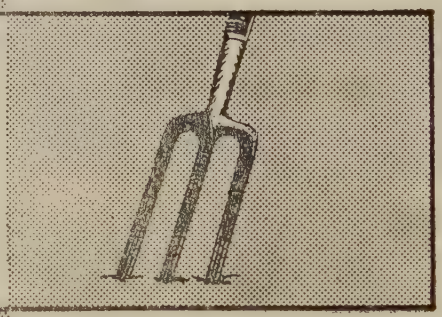

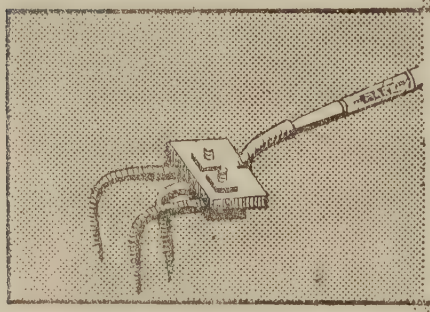

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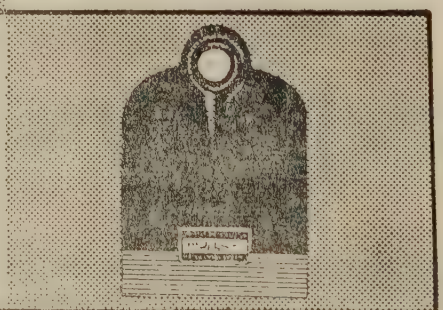

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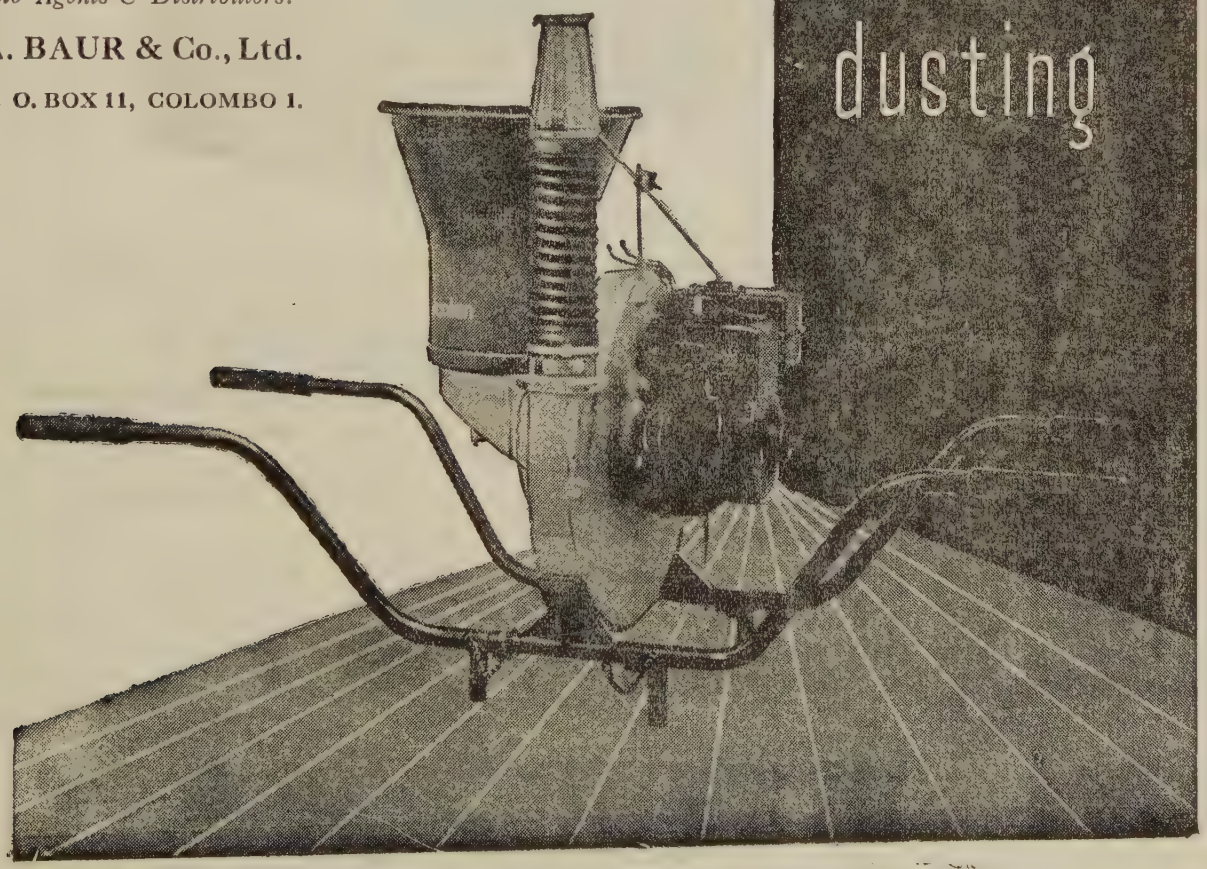

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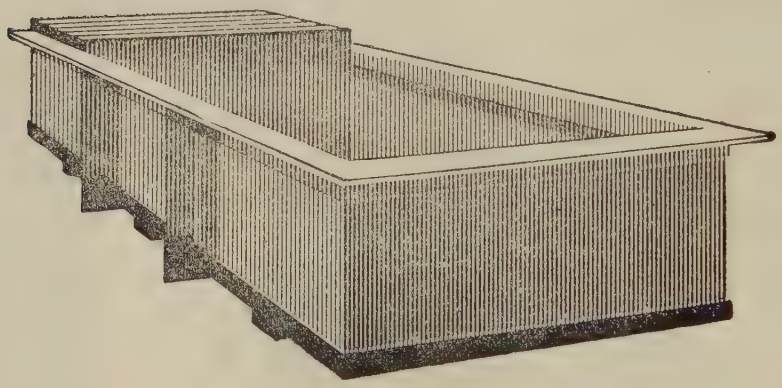

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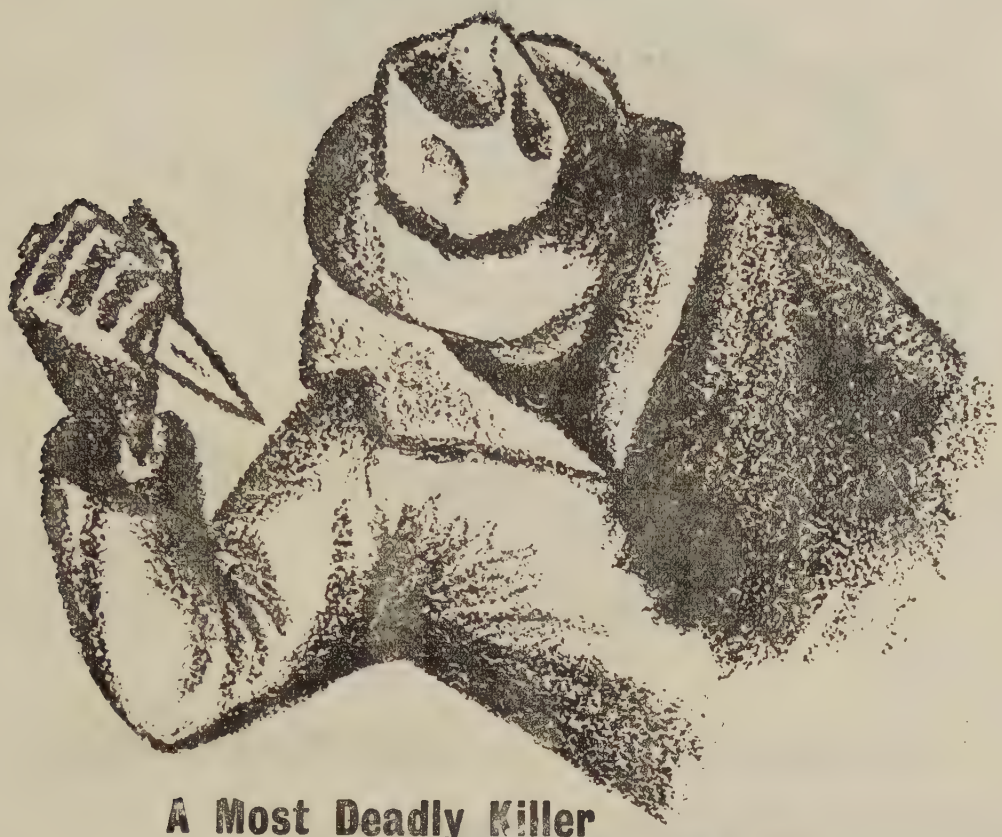

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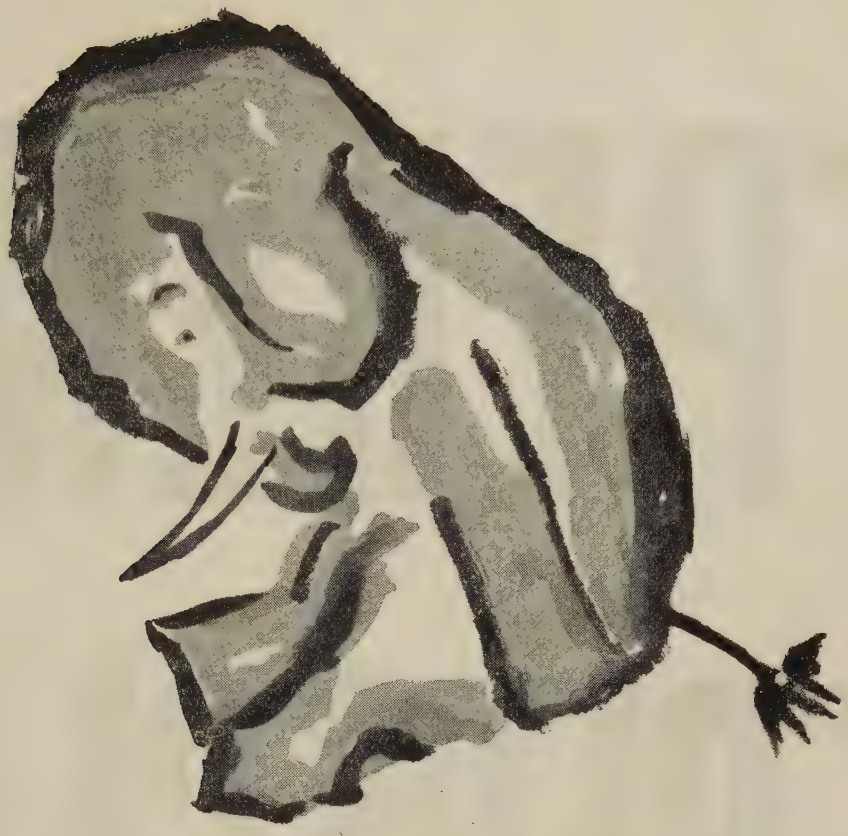

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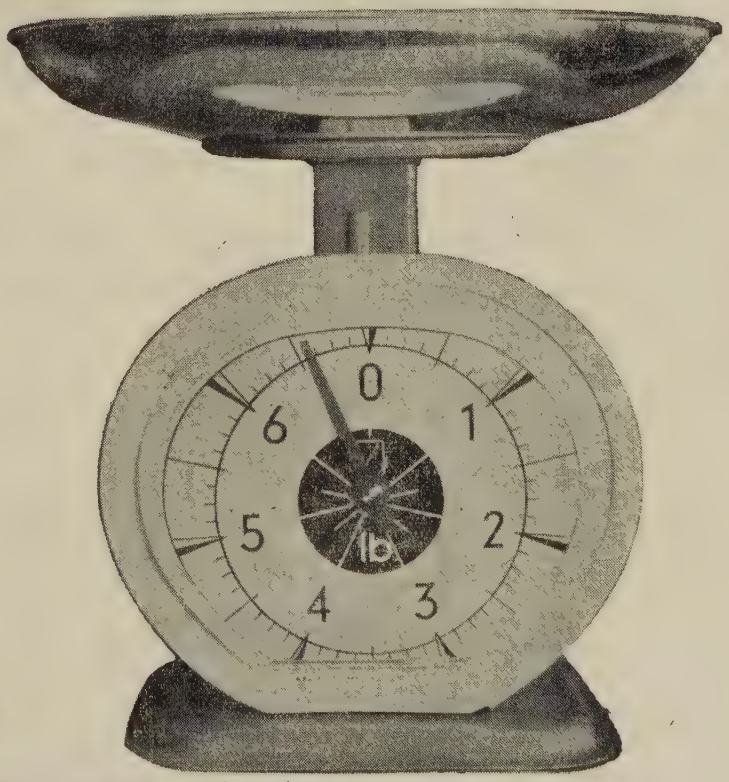

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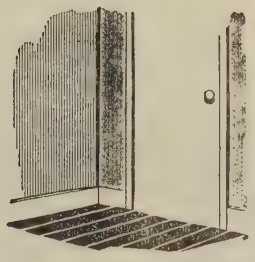

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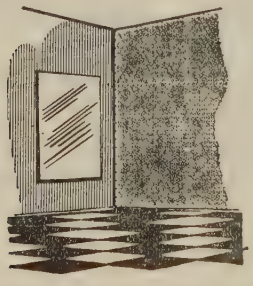

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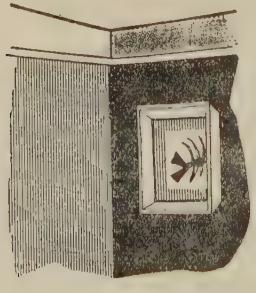

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An especially easy finish to apply by brush or roller, drying to a perfect flat finish in 2-3 hours. Suitable for walls and ceilings, also hardboard, fibre-board, etc. It has great obliterating power, can be applied, if needed, coat-on-coat. 20 delightful, intermixable pastel shades.

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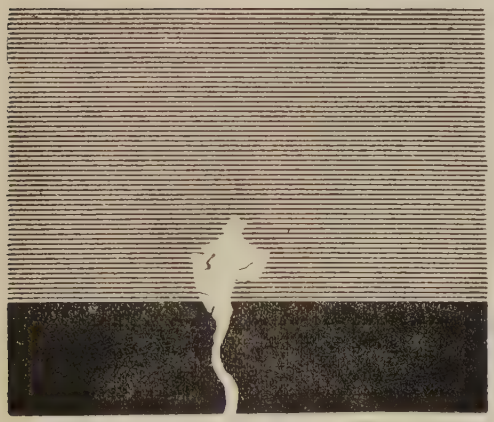

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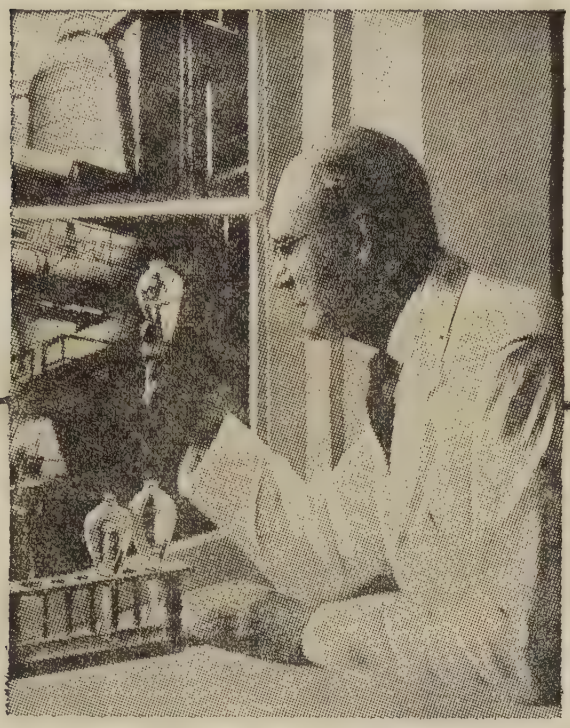

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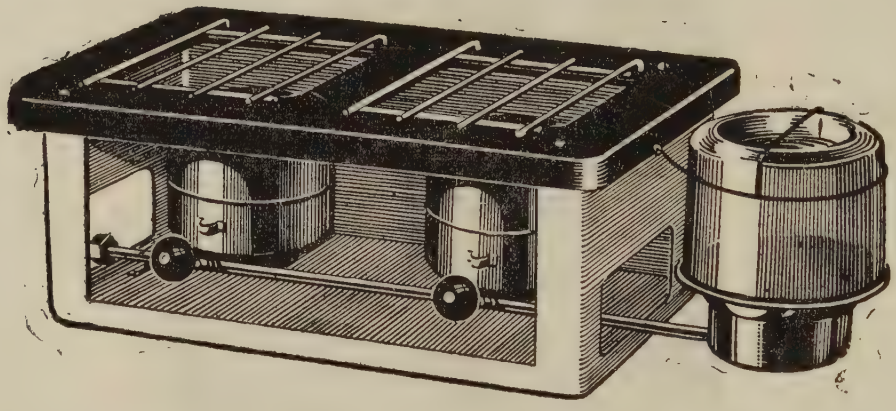

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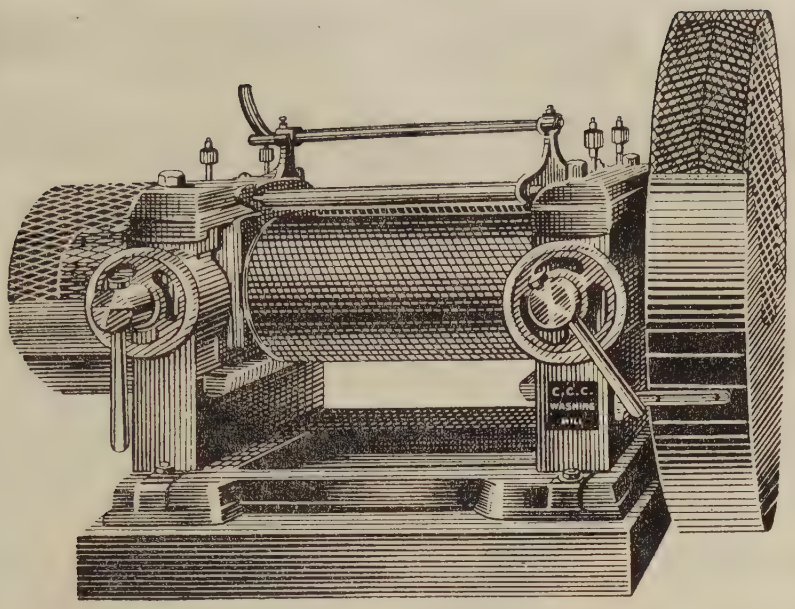

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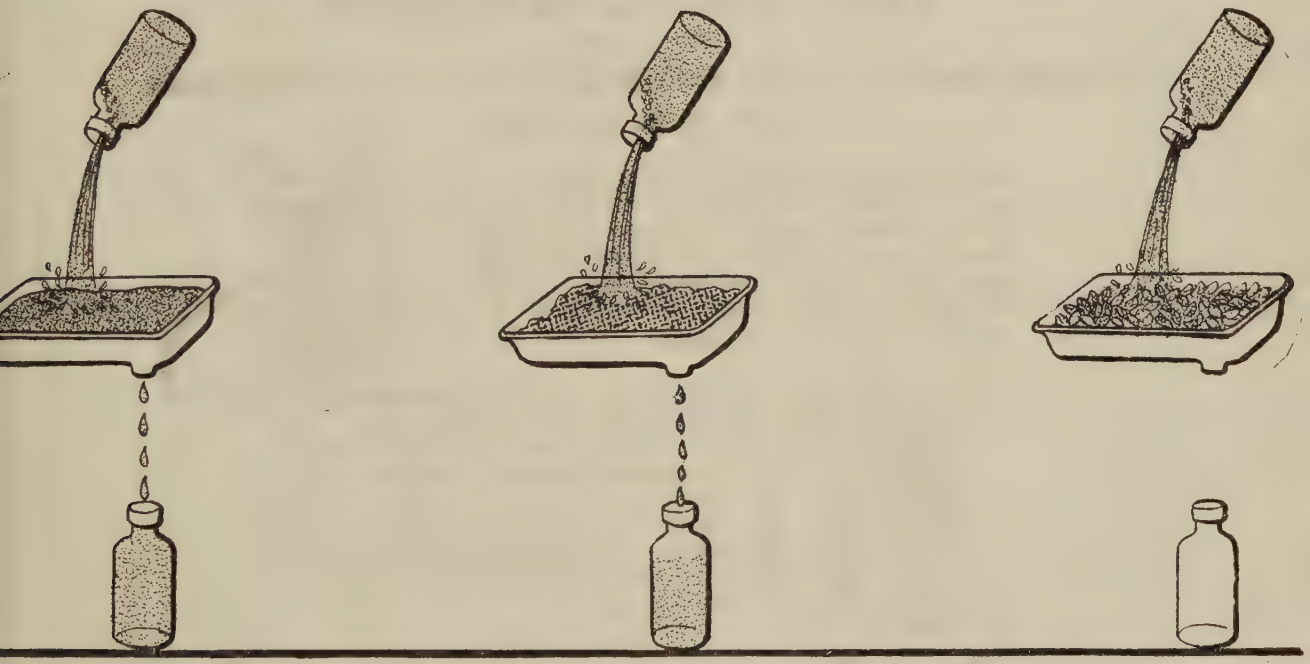
Help *SOIL CONSERVATION* Retain *SOIL MOISTURE*

Add humus or vegetable matter to the soil, which increase capacity to retain rain water on lands. Prevent surface soil wash and erosion. Suppress weeds, thus, saving on labour. Leguminous plants fix atmospheric nitrogen in soil. Ensure continuity of full production with the increased fertility by the conservation of top soils under cover crops. Organic matter and leaf mould deposits help retain rain water on lands.

Now considered an advance in agriculture and is a requirement under Government Subsidised Schemes that Tea, Rubber, Cocoa and Coconut Replantings of uneconomic fields should be perfectly covered with leguminous green manure cover crops during first year before final payments are made.

To obtain best results, mix two parts of seed with one part of Saphos Phosphates and one part of dry earth or sand and sow in beds 4ft. by 4ft. and 6ft. apart between the rows of your plantation in the case of Creeper Ground Covers and sow in drills between the rows of your plantation and in ridges and contour bunds in the case of Bush Cover Crops. Tree Covers are established for shade, as Windbelts and for Timber and Fuel Purposes.

GOVERNMENT NOW CONTEMPLATES ENFORCING LEGISLATION ON SOIL CONSERVATION !!



If a bottle of water is poured into a tray filled with sand, the water is completely drained out. The same quantity of water is poured into a tray filled with earth, only a fraction of the water is retained and the major portion of the water is drained out. See the same quantity of water poured into a tray filled with leaf mould and organic matter, the water is sucked in completely and practically all the water is retained in the tray. Thus, in sandy soils, all rain water is drained out and on other soils, only a part is retained on the land, but, where Leguminous Green Manure Cover Crops are established, all the rain water is retained on your land due to organic matter, dry leaf mould and green mulching.

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Throughly proved in Ceylon, and competitively priced, Mysto Sprayers are fine value for money.

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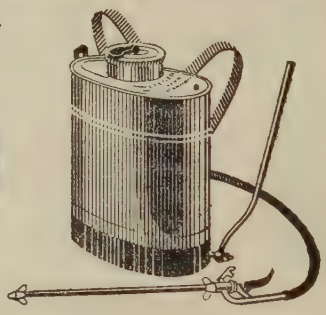
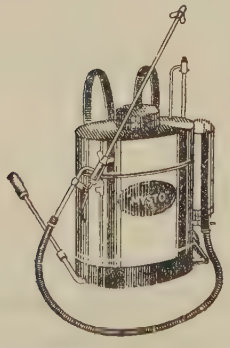
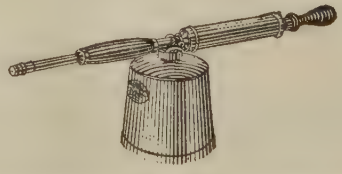




The general purpose Mysto sprayer No. II: is capable of maintaining pressures of 100 lbs. per sq. in.; Minimum of pumping is necessary, and the handle can be used either right or left handed. Capacity $3\frac{1}{4}$ gallons.

Model 144 hand - sprayer: Manufactured of best quality brass. Container is seam-welded.



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